THE

Malayan Agricultural Journal.

NOVEMBER, 1934.

EDITORIAL.

The Cultivation and Manuring of Coconuts.

The results obtained in other countries on the cultivation and manuring of coconuts have but a limited application to the conditions in Malaya. The coconut soils of Malaya are heavy, whereas those in most countries in which coconuts are of importance are light sandy soils. The fact that coconuts respond to manuring in Ceylon, for instance, does not imply that it is equally suitable to Malayan conditions.

The response of coconuts in Malaya to cultivation and manuring has been the subject of study in the Department of Agriculture for the past few years. The summary of results of the experimental work during the last four years is given in an article under the title "Experiments on the Cultivation and Manuring of Coconuts in Malaya" which constitutes one of the chief features of the present number of this journal.

Although exceptions may be found, it is shewn that on normal soils in Malaya, with palms between 10 and 21 years of age, neither manuring nor liming of coconut areas will prove economical. The most satisfactory system would appear to be to supply the area with a cover which is periodically cut and to concentrate attention on adequate drainage.

In addition, investigation has been made into systems of cultivation; the comparative effects of cover slashed periodically, cover buried twice a year, and clean weeding with and without cultivation. The effect of these systems on the different estates on which the experiments were conducted is detailed and will repay study.

Experiments on cultivation and manuring coconuts must be interpreted from two points of view. In the first place, consideration must be given to a determination of the degree of significance of the results; and secondly, the practical man expects that experimental work on crop production shall not be entirely alienated from its practical aspect. Increased crop production may normally be anticipated as a result of judicious manuring and cultivation. As the yield thus increases, the cost of production of each extra unit of increase also rises, until a point is reached at which no further economic increase of production is possible.

It follows, therefore, that in times when the product demands a high market price, it pays to produce the higher units of production, whereas in times of low prices, lower production must prove more remunerative.

The conclusions regarding treatment of the land for coconut production have been reached with due regard to the financial aspect of the problems. The curtailment of expenditure with the least diminution of crop must be the basis of consideration at the present time, and it is in this light that these results of investigations of the Department of Agriculture are interpreted.

The Oil Palm Inflorescence.

The article in this number on the floral morphology of the oil palm places on record the facts in a complete form which we believe has not hitherto been attempted elsewhere. The planter of oil palms may possibly glance at the article and conclude that the writer in entering into the realms of botany thus alienates himself from estate interests. Closer consideration, however, may convince him that an appreciation of floral morphology of the oil palm is of very great practical value on the estate. The flower results in the fruit and one of the subjects upon which we venture to predict we have not yet heard the last word is the extent to which artificial pollination of oil palms is justified. The present article forms an introduction to this subject of pollination to which the author will return in a subsequent number.

Agriculture in Johore.

The Report on Agricultural Development in Johore, by Dr. H. A. Tempany, C.B.E., covers, without the Appendices, twenty-seven pages. The preparation of an abstract of this document proved somewhat difficult. The report is an authoritative statement of the present condition and great value of agriculture in that State, and indicates the future possibilities of development. The abstractor is faced with the alternative of exceeding the available space for the abstract, or of doing injustice to the author by reason of the omission of subject matter which is used cumulatively to support the writer's conclusions.

The main argument of the report is to shew the rapid growth of agriculture in Johore and the fact that at present a point has been reached at which production has attained its greatest height under the existing systems of cultivation. Further progress depends on greater systematization, the adoption of methods whereby husbandry may replace mere crop production. The plea, therefore, is for a close regard of the results of investigations already carried out by the Department of Agriculture, Straits Settlements and Federated Malay States; for the inauguration of further experimental work on the particular problems which have become evident; and for the shouldering by the Johore Government of its share of the cost of the services of this organisation in view of the fact that the research work of the Department is of direct value to that State.

Original Articles.

EXPERIMENTS ON THE CULTIVATION AND MANURING OF COCONUTS IN MALAYA

(Summary of Results obtained between 1930 and 1934)

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In previous issues of this Journal (1) an account has been given of cultivation and manurial experiments on coconuts, with results to the end of 1932. The lay-out has been fully described and consists of sixteen 16-tree plots used to test four surface treatments: (a) cover slashed every three months, (b) cover buried to a depth of seven inches twice a year, (c) clean weeding with cultivation to a depth of seven inches twice a year, and (d) clean weeding without cultivation. Each plot is divided into four 4-tree sub-plots with the following treatments: (i) a complete manurial mixture of whale guano compound 2½ lbs., steamed bone meal 6 lbs. and muriate of potash 1½ lb. per tree (designated for convenience NPK), (ii) the complete mixture as in (i) with lime at the rate of 10 piculs (approx. 12 cwts.) per acre (LNPK), (iii) lime alone at the same rate (L), (iv) control.

Nitrogen was supplied in organic form as it was thought possible that owing to slow decomposition it might be made available for a longer period than would be the case if inorganic fertilizers, such as ammonium sulphate or calcium cyanamide, were employed. Subsequent work (2) on the nitrification of castor cake has rendered this doubtful. A complete mixture was used as it was desired to ensure that none of the three essential elements most likely to be deficient would be lacking. Repeated deep cultivation, whether of clean-weeded areas or in the process of burying the cover crop, although known to be impracticable as a commercial proposition, was given to ensure that its absence should not act as a limiting factor in these experiments.

At the inception of the experiments, variation among palms was known to be great (3) so that it was not expected that significance in any one year would be attained for differences of less than say 25 per cent. of the mean. In view of the price ruling for copra ($5 per picul), then thought to be low, this was immaterial, since smaller differences would not repay cost of treatment. As explained in previous articles, it was desired to spread the experiments over as wide a variety of soils as possible and with the means available it would have been a physical impossibility to deal with greater numbers of palms.

Since the time from flowering to maturity of nuts is approximately eleven months, it may be assumed with some confidence that yield will be unaffected by treatments or manures during the first year of the experiment and that these results may be used as additional controls for those of subsequent years. This is confirmed by another experiment on liming of a very acid soil, results of which will be published later.

Table I gives general particulars; Table II, analyses of the soils under experiment; Table III, the mean water level in drains and dates of application of manures. Table IV gives results of nut counts for the full period of the experiment.

In Table IV means for the four surface and four manurial treatments are given. It is possible, in addition, to derive sixteen means for the combinations of surface and manurial treatments; *e.g.* cover slashed — NPK — LNPK — L and — control; cover buried — NPK — LNPK — L and — control; analysis of the 1933 results shows interaction to have been absent between surface treatments and manures, and to avoid complication of Table IV these sixteen means have been omitted. The opportunity has been taken to correct a number of slips and one serious error in tables previously published.

All statistical working has been carried out by expressing yields as a percentage of the annual general mean in each case, as this facilitates comparison from year to year.

A word on "significance" may be useful. No experiment and no system of statistical analysis can give certainty to a result; all that such analysis can do is to provide an estimate of the reliability to be attached to results. In agricultural experiments when the odds are 20 to 1 against differences obtained being due to chance, such results are said to be "significant" and worthy of consideration. Whether, even if significant differences are obtained, treatments can be recommended is, of course, a matter of economics.

In analysis two tests are available, one known as the "Z" test, indicating whether or not significance exists anywhere in the results obtained and the other the "t" test, which may be extended to calculate the minimum difference required for significance between any pair of treatments and hence to find the location of the significance indicated by "Z".

In all cases for 1933 and 1931 the minimum differences for significance have been calculated, even where such differences were obviously not attained, in order to arrive at an estimate of the order of differences capable of detection in these experiments.

In border-line cases it sometimes happens that the "t" test will indicate significance where the "Z" test does not; in theory the positive evidence may be accepted, but the writers prefer to regard such cases as "not proven".

Results in the rows $y—bx$ are obtained by the method of covariance of Sanders (4), by which an estimate may be made of the part played by the permanent factors — inherent character of the palms and soil variation. The

figures in these rows do not represent hypothetical mean yields, but only that portion of the actual yield which cannot under the conditions of the experiment be assigned to permanent factors; differences shown between mean yields are therefore more likely to be due to treatment than are those in the 1932 to 1933 rows where inherent yield capacity may play a part. In an endeavour to indicate the theoretical nature of figures in this row, mean numbers of nuts have been given in whole numbers only.

It will be observed that analysis of the January—June 1934 results has not been undertaken. They reveal no new differences and the experimental error may be taken as of the same order as that of the whole of 1933, except in the case of Estate B where numbers are so small that the error is probably very great.

Size of Nuts.

Before discussing results in Table IV in detail the question of nut size must be considered.

In addition to influencing numbers of nuts produced or brought to maturity, treatments may affect the size and consequently weight of nuts or the water content of the meat.

Under the conditions of these experiments conversion of separate parcels of nuts into copra was an impossibility and an indirect method was essential. As mentioned in last year's summary, Mr. F. C. Cooke (Officer-in-Charge, Copra Investigations) showed that there was a close relationship between weight of husked nut and meat. This has subsequently been confirmed in Ceylon. Water content of meat varies within such narrow limits that this source of variation may be excluded and the assumption made that any change of resultant copra will be indicatd by change in weight of husked nuts. Unfortunately, this relationship was not proved until the latter part of 1932 so that a back check cannot be applied. During 1933 the total weight of husked nuts as well as numbers from each sub-plot were recorded on three occasions, *viz.* in February, June and October, and Table V gives mean numbers and weights. It will be seen that there are no variations of any order likely to be significant.

In order to test the reliability of three observations, the relationship of numbers recorded for three collections to those for the whole year was ascertained and found, as Table VII shows, to be close.

The weight of the mean nut for each treatment may be ascertained from the data in two ways which will not necessarily give concordant results. For the first, total (or mean) weights for each treatment may be divided by the total (or mean) numbers; for the second, the separate sub-plot totals (or means) may be employed and one "ideal" not supposed to be harvested from each sub-plot. The former method gives a mean correctly weighted for numbers of nuts and is the one of practical value, the latter gives results susceptible of statistical analysis. As Table VI shows, there are rarely serious differences between the figures obtained by the two methods. Both from the common-sense and

statistical view-points, the table shows that with one exception, large variations ascribable to treatments are absent; only in the case of Estate F does variation attain significance by both tests and then amounts to 8 per cent. only as the result of liming. This confirms the impression derived from visual comparison of numbers and weights in columns I and II, and very strongly indicates that for these experiments the only changes which need be considered are those of numbers of nuts.

Discussion of Results.

Reverting to Table IV and comparing differences in the $y—bx$ rows between pairs of manurial treatments with the minimum significant differences, it is seen that, with the exception of Estate B, neither manuring nor liming nor the combination was anywhere definitely significant. Estate B is exceptional and will be discussed separately. Estate F is a border-line case; the "Z" test shows no significance, but by the "t" test liming is just better than the control : doubt is cast on this, however, by the fact that the increase of yield from lime and manure does not attain significance.

Surface Treatments.

There are no significant differences on Estates A and G. On Estate B the two bare surface treatments, cultivation and clean-weeding, are definitely better than two treatments involving growth of a cover.

On Estate C the two bare surface treatments are just better than cover slashed but not than cover buried; the fact that such differences as occur are significant is due to the remarkably small experimental error shown on this Estate. On Estate D cultivation is just possibly better than cover buried.

Estate E. The two bare surface treatments are definitely better than cover buried and suggestively close to significance over slashed.

Estate F. Cultivation is definitely better than cover buried and just better than cover slashed; it just misses significance over bare surface without cultivation. The soil on this Estate is exceptionally heavy and these results, together with those of the effect of liming on the size of nuts, are not unexpected.

Excluding Estate B, such significant increases as have occurred are of the order of 10 per cent. of the mean, or roughly of 1 picul of copra per annum, worth say $3. Putting manufacture, collection and transport at 80 cents per picul there remains $2.20 per acre per annum. For a return such as this, cultivation is obviously out of the question, and clean weeding would cost not less than $6 per acre under the most favourable condition. It follows, therefore, that for estates on what may be called "normal" Malayan soils with palms of ages ranging from 10 to 21 years, neither manuring with any reasonable quality of manure, liming, nor any form of soil treatment studied, nor any combination of the two is likely to give economic returns. This conclusion is supported by large-scale manuring and liming trials (not capable of statistical analysis) carried out on Estate A several years ago and by experiments of several

years duration on an estate not in this list carried out by Dr. H. W. Jack (late Economic Botanist of this Department). The latter experiments were spoilt for analysis by unexpected variation in time of the plots, most likely due to sub-soil variations, but would have shown indications of large differences if such had existed.

The cover in these experiments was slashed; uncontrolled growth may possibly have resulted in greater differences.

This absence of response must be due to one or more limiting factors other than those under observation. Factors which suggest themselves are inherent yielding capacity of the unselected Malayan palm population, soil aeration, and chemical composition and water supply. Although the soils of Estates A, C—G vary among themselves, they are all heavy compared with many Ceylon coconut soils and the very sandy soils or almost pure sands of many tropical islands where coconuts are grown. Reasonable growth on "normal" Malayan coconut soils is, in fact, dependent on intensive drainage.

This heavy texture might possibly prevent sufficient aeration of the roots to permit of response to manures, and it was for this reason that cultivation was included; only on the heaviest soil of all has any marked response to cultivation been obtained, but even in this case there was no special response of the cultivated plots to manurts. It must, therefore, be concluded that, given adequate drainage, lack of soil aeration is not the obstacle which inhibits largely increased crops as the result of manuring.

Convincing proof that insufficient soil moisture is not the cause of soil lack of response in these experiments is furnished by Estate "D" which is provided with an efficient system of sub-soil irrigation. Here manures should have had free play, but have effected nothing.

Incidentally, it is puzzling to find that on this estate nut size is the smallest recorded. The writers can only suggest that the palms are, as a whole, very near the upper limit of their yield capacity under the whole congeries of soil and meteorological conditions on any given "normal" estate and cannot be materially influenced by any economic or near economic treatment.

On Estate B the situation is totally different. The trees are very old, the soil is light and poor and the property is understood to have been somewhat neglected in the past.

Yields have obviously been largely increased by keeping the surface bare and also by the application of lime and fertilizer. Examination of the sixteen sub-means set out in Table VI suggests that there may have been differential response to manures superimposed on different surface treatments and apparent confirmation is given to this by analysis of the 1933 results alone. However, when the considerable initial variation shown in 1931 is allowed for by application of covariance, this is seen to be illusory. The fact that there is no *differential*

response does not mean that a better response is not obtained when two good treatments meet and this is indeed found to be the case, highest yields being obtained by combination of lime, fertilizer and bare surface.

From the financial standpoint it will be noted that clean weeding without manurial application gave a corrected increase of 22 nuts per palm over the corresponding cover-slashed plot, whereas the addition of lime and fertilizer gave an additional 20 nuts.

Twenty nuts per palm at 50 palms per acre and 250 nuts per picul of copra may be taken as approximately equivalent to 4 piculs—valued at $2.20 (vide page 514) per picul which gives a return of $8.80 per acre per annum in return for an expenditure of $5 or $6 for clean weeding and a similar return for a lime manurial mixture costing say $15 per acre. The former would be remunerative, the latter would not. There is some evidence, however, from another source that one application of lime may have effects lasting three or more years; if this should prove to be the case, the application would be considerably reduced in cost. The manurial mixture actually used in these experiments is relatively expensive and from what is now known could almost certainly be replaced by cheaper artificial, *e.g.* ammonium sulphate or calcium cyanamide and rock phosphate or basic slag. If cyanamide and slag were used it might be possible to dispense with additional lime and to reduce the cost of annual application to $5 or $6.

Even this one apparently financially satisfactory result is open to doubt. 1933 was a peak year everywhere; increases in 1932 were smaller and the figures for the first half of 1934 are disconcerting, the more so as the relative position of the different treatments is approximately maintained, which excludes the obvious possibility that the drop in mean yield is due to exhaustion of manures or lime. (None was applied in 1933 or 1934).

Here then the commercial feasibility of treatment in the broad sense cannot be regarded as definitely proved and judgement must be reserved until figures for the whole of 1934 are available.

The Future of the Experiments.

Records have been discontinued since the end of June 1934 on all Estates except B as it seems clear that little useful purpose will be served by continuing the experiments in their present form. The results obtained should be of value although negative, as showing directions in which waste of money can be avoided.

It is proposed to investigate the possibility of growing less dense covers than Centrosema on heavy soils under mature coconuts, in the hope that they may combine the advantages of clean-weeding with the cheapness of a cover. If these attempts are successful the experiments will be reorganised to test their effect on yield. Recording on Estate B continues and it is intended to make a fresh manurial application next year, using the cheapest possible mixture.

Summary.

An account is given of experiments in progress since 1931 on seven coconut estates.

It is shown that on 'normal' soils neither manuring, liming nor clean weeding is likely to increase yields from mature coconuts to an economic degree over those obtained from unmanured plots with cover kept under control.

On one of the Estates on poor light soil, large responses to clean-weeding and to application of manures and lime were obtained, but owing to a heavy drop in yield in the first part of 1934 definite conclusions cannot yet be drawn.

It is desired again to emphasize that the conclusion in paragraph two applies to normal areas of palms from 10 to 20 years old not over-drained.

There is some evidence that a cover may considerably retard young coconuts or older palms on over-drained soil. On an area of exceedingly acid soil (pH 2.0 to 3.5) liming has been shown to be of benefit. Such areas are fortunately not of frequent occurrence.

The writers wish to express their thanks to the managers of the estates on which these experiments were carried out for continued help freely given, and to Che Shaffie bin Mohamed Taib, Che Abdul Malik bin Abdul Pakih and Che Abdul Chaffar bin Sidek for their care in the labourious task of recording.

Appendix.

For the benefit of the statistically minded Table VII, giving standard deviations etc., is appended. It should be explained that one of us only (W.N.C.B.) must bear the blame for errors of computation which may have occurred in the tables and analyses.

It will be noted that instead of "Z"—a "Z ratio" is given; this is the ratio of the appropriate variances and is that number of which half the natural logarithm is Z. The writer personally has found it easier once and for all to construct a table of numbers corresponding to Fisher's table of "Z" and use these. The necessity at the end of a long calculation to have recourse to log tables is, again personally, peculiarly irritating.

References.

1. Experiments on the Manuring of Coconuts and Oil Palm. Compiled from Department Records. *Malayan Agricultural Journal* Vol. 20, page 105, 1932.
   Manuring Experiments with Coconuts and Oil Palm—W. N. C. Belgrave and J. Lambourne. *Malayan Agricultural Journal* Vol. 21, page 543, 1933.
2. Studies in Malayan Soils III—R. G. H. Wilshaw, *Malayan Agricultural Journal* Vol. 22, page 4, 1934.
3. Variation in Coconuts—H. W. Jack. *Malayan Agricultural Journal* Vol. 15, page 387, 1927.
4. A Note on the Value of Uniformity Trials for Subsequent Experiments. H. C. Sanders. *Journal of Agricultural Science* Vol. 20, page 63, 1930.

Table I.

Estate.	Locality.	Age of palms at commencement of experiment.	Type of soil.	Treatment before experiment started.	Type of cover employed in experiment.
A	Banting	21 years	Alluvial clay loam	Clean weeded	Grass and weeds
B	Province Wellesley-North	Unknown, very old	Sandy soil over white silt	Under grass	Grass
C	Province Wellesley-South	20 years	Heavy clay	Under *Centrosema pubescens* and grass ploughed in at intervals	*Centrosema* and grass
D	Krian District	20 years	Friable clay loam	Clean weeded	*Centrosema* and *Mikania scandens*
E	Bagan Datoh	20 years	Heavy clay	Grass, *Centrosema* and fern	Grass, *Centrosema* and fern
F	Sabak Bernam	17 years	Very heavy clay	Leguminous covers and weeds. Block 4 *Centrosema* and grass	Grass and leguminous covers Blocks 1-3 *Centrosema* in Block 4
G	Sepang	10—11 years	Peat overlying heavy clay	3 blocks under weeds and fern. 1 Block *Mikania scandens*	3 blocks under weeds and fern. 1 block under *Mikania scandens*

Table II.

Soil Analysis

		Physical						Chemical							
								pH		Oven dried per cent.		Ignited per cent.			
		Gravel	Coarse sand	Fine sand	Silt	Clay	Loss on Ignition	Suspension	Filtrate	Carbon	Nitrogen	CaO	Sesqui Oxides	K_2O	P_2O_5
		Per Cent.													
Estate A	Top Soil	Nil	Nil	27	30	41	11	4.3	6.0	3.56	0.220	0.088	13.40	0.718	0.044
	Sub „	„	„	21	27	53	9	3.9	4.8	2.55	0.150	0.043	15.22	0.742	0.032
Estate B	Top Soil	6	31	23	18	18	4	4.5	6.6	1.31	0.105	0.045	11.22	0.201	0.024
	Sub „	6	33	18	19	21	5	5.0	7.0	1.14	0.080	0.038	10.79	0.209	0.021
Estate C	Top Soil	2	7	20	30	43	6	4.8	6.8	2.47	0.171	0.085	13.89	0.638	0.158
	Soil „	2	8	27	24	39	8	5.0	7.0	2.36	0.143	0.121	12.47	0.549	0.087
Estate D	Top Soil	Nil	Nil	24	34	37	12	4.3	6.2	4.25	0.224	0.136	14.73	0.681	0.087
	Sub „	„	„	17	41	43	11	3.8	6.0	4.02	0.213	0.196	13.85	0.598	0.229
Estate E	Top Soil	Nil	Nil	2	29	70	13	4.0	6.8	2.43	0.238	0.196	24.23	0.921	0.075
	Sub „	„	„	3	29	69	12	4.6	6.6	3.05	0.210	0.070	23.35	1.101	0.075
Estate F	Top Soil	Nil	Nil	2	31	68	11	4.4	7.0	1.74	0.164	0.091	21.14	0.628	0.049
	Sub „	„	„	1	32	68	9	4.4	6.8	1.11	0.098	0.039	21.41	0.683	0.031
Estate G	Top Soil	not determined					26	4.0	5.0	10.99	0.388	0.165	8.73	0.518	0.064
	Sub „	Nil	Nil	32	32	37	17	3.7	5.6	6.72	0.259	0.072	13.85	0.713	0.057

Table III.

Estate.	Mean water level in drains.	Dates of Application of Manures.			
		1st application.		2nd application.	
A	2½-3 ft.	11.7.30	31.7.30	—7.31	—8.31
B	2 -3 ft.	5.1.31	9.2.31	18.1.32	22.2.32
C	2½-3¾ ft.	4.3.31	24.3.31	23.2.32	19.2.32
D	2-2½ ft.	6.1.31	20.2.31	5.1.32	24.2.32
E	2 ft.	8.1.31	12.2.31	8.2.32	26.2.32
F	2-4 or 5 ft.	9.1.31	13.2.31	9.2.32	27.2.32
G	4 -5 ft.	26.1.31	23.2.31	31.1.32	9.3.32
				9.8.32	30.8.32

Table IV.

Results of Nut Counts.

Estate A.

		Cover slashed	Cover buried	Clean weeded & cultivated	Clean weeded only	Minimum difference for significance between any pair of treatments	N P K	L N P K	Lime	Control	Minimum difference for significance between any pair of treatments	Minimum increase for significance over control	General Mean Nuts per Palm
1931	Percentage of General Mean	98.0	106.6	99.4	95.4	23.6	99.3	103.2	94.1	103.4	17.9	10.8	
	Nuts per Palm	*54.1*	*58.1*	*54.7*	*52.8*		*55.0*	*56.9*	*52.0*	*57.1*			*55.2*
1932	Percentage of General Mean	95.5	99.3	102.1	103.2		92.0	104.0	102.3	101.7			
	Nuts per Palm	*45.2*	*48.3*	*48.8*	*47.0*		*43.5*	*49.2*	*48.5*	*48.3*			*47.4*
1933	Percentage of General Mean	100.6	102.3	96.6	100.6	26.6 "Z" not significant	98.0	111.1	94.0	97.0	14.3	8.5 "Z" not significant	
	Nuts per Palm	*64.7*	*65.7*	*62.1*	*64.6*		*63.0*	*71.4*	*60.5*	*62.3*			*64.3*
First half 1934	Percentage of General Mean	101.7	96.5	108.8	92.9		89.3	108.4	103.6	98.6			
	Nuts per Palm	*23.7*	*22.5*	*25.1*	*21.7*		*20.8*	*25.3*	*24.2*	*23.0*			*23.3*
y-bx 1933/31	Percentage of 1933 Mean	42.6	38.1	34.3	40.8	20.5 "Z" not significant	57.0	69.5	57.4	54.1	16.6	12.1 "Z" not significant	
	Nuts per Palm	*28*	*26*	*22*	*27*		*37*	*45*	*37*	*35*			

Estate B.

		Cover slashed	Cover buried	Clean weeded & cultivated	Clean weeded only	Minimum difference for significance between any pair of treatments	N P K	L N P K	Lime	Control	Minimum difference for significance between any pair of treatments	Minimum increase for significance over control	General Mean Nuts per Palm
1931	Percentage of General Mean	87.2	118.2	97.7	96.9	71.0	86.6	98.1	87.7	127.6	55.0		
	Nuts per Palm	*11.3*	*15.3*	*12.7*	*12.6*		*11.3*	*12.8*	*11.4*	*16.7*			*13.0*
1932	Percentage of General Mean	86.5	87.1	132.8	93.7	31.4	96.7	111.3	91.4	100.5		22.8	
	Nuts per Palm	*20.2*	*21.1*	*31.0*	*20.3*		*22.6*	*25.9*	*21.3*	*23.5*			*23.4*
1933	Percentage of General Mean	55.0	80.0	135.8	129.4	39.0 "Z" not	88.7	120.1	98.8	92.5	20.6 "Z" just	16.8	
	Nuts per Palm	*20.9*	*30.4*	*51.6*	*49.2*	significant	*33.7*	*45.7*	37.5	35.2	significant		*38.0*
First half 1934	Percentage of General Mean	72.1	78.5	130.1	118.7		97.3	116.9	93.4	92.0			
	Nuts per Palm	*4.9*	*5.4*	*8.9*	*8.1*		*6.7*	*8.0*	*6.4*	*6.3*			*6.8*
y-bx 1933/31	Percentage of 1933 Mean	11.4	20.9	96.9	81.0	18.4 "Z"	69.6	98.4	79.4	64.4	16.9 "Z"	13.7	
	Nuts per Palm	*4*	*8*	*37*	*31*	significant					significant		

Estate C.

		Cover slashed	Cover buried	Clean weeded & cultivated	Clean weeded only	Minimum difference for significance between any pair of treatments	N P K	L N P K	Lime	Control	Minimum difference for significance between any pair of treatments	Minimum increase for significance over control	General Mean Nuts per Palm
1931	Percentage of General Mean	101.1	96.8	102.7	98.9	6.8 "Z" not significant	101.1	94.8	103.2	100.5	8.3 "Z" not significant	6.8	
	Nuts per Palm	*88.9*	*85.0*	*90.3*	*86.7*		*88.9*	*83.1*	*90.2*	*88.1*			*87.6*
1932	Percentage of General Mean	92.3	98.0	103.5	106.2		104.2	92.4	101.4	102.0			
	Nuts per Palm	*81.9*	*87.0*	*92.1*	*94.0*		*92.6*	*81.8*	*90.0*	*90.5*			*88.7*
1933	Percentage of General Mean	95.7	95.7	105.0	103.6	7.9 "Z" not significant	101.3	93.0	107.8	97.9	11.6 "Z" not significant	9.5	
	Nuts per Palm	*96.2*	*96.2*	*105.7*	*104.3*		*102.0*	*93.6*	*108.5*	*98.6*			*100.6*
First half 1934	Percentage of General Mean	99.7	92.9	106.8	100.4		106.2	94.5	99.1	100.1			
	Nuts per Palm	*41.1*	*38.3*	*44.5*	*41.4*		*43.8*	*39.0*	*40.9*	*41.3*			*41.2*
y-bx 1933/31	Percentage of 1933 Mean	44.2	48.3	52.7	52.3	6.8 "Z" significant	9.3	6.6	13.7	6.4	8.4 "Z" not significant	6.9	
	Nuts per Palm	*44*	*48*	*53*	*52*		*10*	*7*	*14*	*7*			

Estate D.

		Cover slashed	Cover buried	Clean weeded & cultivated	Clean weeded only	Minimum difference for significance between any pair of treatments	N P K	L N P K	Lime	Control	Minimum difference for significance between any pair of treatments	Minimum increase for significance over control	General Mean Nuts per Palm
1931	Percentage of General Mean	91.4	107.0	102.5	99.1	16.0 "Z" not significant	94.7	101.7	98.1	105.4	15.0	12.1	
	Nuts per Palm	*63.2*	*73.0*	*70.0*	*67.7*		*64.5*	*69.9*	*67.9*	*71.9*			*68.1*
1932	Percentage of General Mean	84.9	101.1	113.5	100.5	16.9 "Z" not significant	89.6	99.3	104.0	107.0	18.5 "Z" not significant	15.0	
	Nuts per Palm	*55.2*	*65.9*	*74.9*	*65.5*		*58.2*	*64.5*	*67.6*	*69.8*			*65.2*
1933	Percentage of General Mean	94.0	95.0	110.5	100.2	20.4 "Z" not significant	100.2	105.0	94.3	100.4	12.5 "Z" not significant	10.2	
	Nuts per Palm	*75.1*	*76.1*	*88.6*	*80.2*		*80.2*	*84.0*	*75.3*	*80.6*			*79.9*
First half 1934	Percentage of General Mean	91.8	92.3	109.6	106.2		92.2	103.1	104.1	101.5			
	Nuts per Palm	*31.1*	*31.3*	*37.6*	*36.0*		*31.2*	*34.9*	*35.4*	*34.3*			*33.9*
y-bx 1933/31	Percentage of 1933 Mean	35.8	21.5	44.8	37.1	18.8 "Z" not significant	51.1	82.1	43.6	45.5	9.5 "Z" not significant	7.8	
	Nuts per Palm	*28*	*17*	*35*	*30*		*41*	*41*	*35*	*36*			

Estate E.

		Cover slashed	Cover buried	Clean weeded & cultivated	Clean weeded only	Minimum difference for significance between any pair of treatments	N P K	L N P K	Lime	Control	Minimum difference for significance between any pair of treatments	Minimum increase for significance over control	General Mean Nuts per Palm
1931	Percentage of General Mean	102.8	96.8	103.2	97.1	19.3 "Z" not significant	97.5	105.0	95.5	101.8			
	Nuts per Palm	*76.7*	*72.1*	*77.2*	*72.4*		*72.7*	*78.4*	*71.1*	*75.1*			*74.6*
1932	Percentage of General Mean	100.1	100.6	102.4	96.8		98.2	99.0	93.1	109.7			
	Nuts per Palm	*64.7*	*65.0*	*66.1*	*62.6*		*63.5*	*64.1*	*60.1*	*70.6*			*64.7*
1933	Percentage of General Mean	97.1	90.5	107.2	105.2	15.6 "Z" not significant	96.5	105.1	94.2	104.1	11.5 "Z" just significant	9.1	
	Nuts per Palm	*69.5*	*76.8*	*75.0*	*64.8*		*69.1*	*75.3*	*67.5*	*74.6*			*71.6*
First half 1934	Percentage of General Mean	89.3	90.1	106.7	113.9		97.5	103.6	96.0	103.0			
	Nuts per Palm	*29.5*	*29.7*	*35.2*	*37.5*		*32.1*	*34.1*	*31.6*	*33.4*			*33.0*
y-bx 1933/31	Percentage of 1933 Mean	48.0	43.2	59.1	58.6	11.8 "Z" not significant	Not determined, obviously no increase over control.						
	Nuts per Palm	*34*	*31*	*42*	*42*								

Estate F.

		Cover slashed	Cover burned	Clean weeded & cultivated	Clean weeded only	Minimum difference for significance between any pair of treatments	N P K	L N P K	Lime	Control	Minimum difference for significance between any pair of treatments	Minimum increase for significance over control	General Mean Nuts per Palm
1931	Percentage of General Mean	103.6	98.9	105.2	92.8	30.8 "Z" not significant	100.7	91.0	103.1	104.8	20.1 "Z" not significant	15.9	
	Nuts per Palm	*49.9*	*47.7*	*50.6*	*44.5*		48.5	43.9	49.6	50.6			*48.1*
1932	Percentage of General Mean	98.3	80.9	117.0	94.9		101.8	98.2	106.0	93.7			
	Nuts per Palm	*45.3*	*41.6*	*53.9*	*43.7*		*46.9*	*45.2*	*49.0*	*43.2*			*46.1*
1933	Percentage of General Mean	98.9	76.4	119.6	95.1	20.4 "Z" not significant	98.4	97.3	110.8	93.5	19.3 "Z" not significant	15.4	
	Nuts per Palm	*44.0*	*32.6*	*60.3*	*48.0*		*49.7*	*49.1*	*55.9*	*47.0*			*50.5*
First half 1934	Percentage of General Mean	100.0	87.6	112.9	99.4		101.2	96.5	106.0	96.3			
	Nuts per Palm	*22.3*	*19.6*	*25.3*	*22.3*		*22.7*	*21.6*	*23.8*	*21.6*			*22.4*
y-by 1933/31	Percentage of 1933 Mean	38.9	29.0	58.6	41.6	17.7 "Z" significant	37.9	12.6	48.8	30.8	14.6 "Z" not significant	11.8	
	Nuts per Palm	*20*	*15*	*30*	*21*		*19*	*22*	*25*	*16*			

Estate G.

		Cover slashed	Cover buried	Clean weeded & cultivated	Clean weeded only	Minimum difference for significance between any pair of treatments	N P K	L N P K	Lime	Control	Minimum difference for significance between any pair of treatments	Minimum increase for significance over control	General Mean Nuts per Palm
1931	Percentage of General Mean	102.3	102.4	98.4	96.9	40.5 "Z" not significant	101.9	96.8	103.2	98.1	24.4 "Z" not significant	19.8	
	Nuts per Palm	*47.3*	*47.4*	*45.5*	*44.8*		*47.1*	*44.5*	*47.7*	*45.3*			*46.1*
1932	Percentage of General Mean	97.0	99.7	93.6	108.8		96.5	101.0	100.6	101.8			
	Nuts per Palm	*53.6*	*55.1*	*51.7*	*60.7*		*53.3*	*55.8*	*55.6*	*56.3*			*55.3*
1933	Percentage of General Mean	96.3	100.6	100.7	102.2	40.2 "Z" not significant	98.3	100.8	100.1	100.7	19.8 "Z" not significant	16.2	
	Nuts per Palm	*50.9*	*53.2*	*53.2*	*54.8*		*52.1*	*53.2*	*52.9*	*53.2*			*52.8*
First half 1934	Percentage of General Mean	91.1	101.4	96.4	101.1		93.7	105.7	95.2	105.3			
	Nuts per Palm	*13.5*	*15.1*	*14.3*	*16.7*		*13.9*	*15.7*	*14.1*	*15.6*			*14.9*
y-bx 1933/31	Percentage of 1933 Mean	26.9	31.1	33.9	36.6	24.8 "Z" not significant	49.0	54.3	50.1	53.0	15.7 "Z" not significant	12.8	
	Nuts per Palm	*14*	*16*	*18*	*19*		*26*	*28*	*26*	*28*			

Table V.

Results of Three Harvests during 1933.

Estate A.

		Cover slashed	Cover buried	Clean weeded & cultivated	Clean weeded only	Minimum difference for significance	N P K	L N P K	Lime	Control	Minimum difference for significance	General Mean
No. of nuts	Percentage of General Mean	98.7	104.1	103.0	94.0		91.8	104.1	97.8	106.2		
	Nuts per Palm	*15.5*	*16.3*	*16.1*	*14.7*		*14.4*	*16.3*	*15.3*	*16.6*		15.7
Weight of nuts.	Percentage of General Mean	104.7	97.6	104.5	92.4		94.5	104.4	100.4	99.8		
	Pounds per Palm	*39.5*	*36.9*	*39.5*	*34.9*		*35.7*	*39.4*	*37.9*	*37.7*		37.7 lbs.
Unit weight of nut. Pounds Derived from Means		2.54	2.26	2.46	2.37		2.48	2.43	2.51	2.27		2.40 lbs.
Unit weight of "ideal" nut Pounds		2.56	2.46	2.42	2.32	0.29 "Z" not significant	2.51	2.41	2.49	2.30	0.20 "Z" not significant	2.43 lbs.

Estate B.

		Cover slashed	Cover buried	Clean weeded & cultivated	Clean weeded only	Minimum difference for significance	N P K	L N P K	Lime	Control	Minimum difference for significance	General Mean
No. of nuts	Percentage of General Mean	61.1	78.7	134.6	125.6		100.0	112.5	88.1	99.3		
	Nuts per Palm	*5.0*	*11.1*	*10.4*	*6.5*		*8.3*	*9.3*	*7.3*	*8.2*		*8.3*
Weight of nuts.	Percentage of General Mean	64.2	83.0	127.0	125.5		98.1	116.6	94.1	90.6		
	Pounds per Palm	*11.9*	*23.4*	*23.1*	*15.3*		*18.0*	*21.5*	*17.4*	*16.7*		*18.4*
Unit weight of nut. Pounds	Derived from Means	2.38	2.11	2.22	2.32		2.16	2.31	2.38	2.03		2.21
Unit weight of "ideal" nut Pounds		2.35	2.35	2.30	2.30	0.40 "Z" not significant	2.28	2.30	2.45	2.27	0.18 0.14 "Z" not significant	2.33

Estate C.

		Cover slashed	Cover buried	Clean weeded & cultivated	Clean weeded only	Minimum difference for significance	N P K	L N P K	Lime	Control	Minsmum difference for significance	General Mean
No. of nuts	Percentage of General Mean	89.3	100.0	103.7	107.0		100.5	91.0	109.4	99.2		
	Nuts per Palm	*21.5*	*24.2*	*25.6*	*25.8*		*24.5*	*22.1*	*26.2*	*24.0*		*24.2*
Weight of nuts.	Percentage of General Mean	94.2	95.3	104.8	105.6		98.2	90.9	108.4	102.6		
	Pounds per Palm	*45.2*	*45.8*	*50.4*	*50.8*		*47.2*	*43.7*	*52.1*	*49.3*		*48.1*
Unit weight of nut. Pounds	Derived from Means	2.10	1.89	1.97	1.97		1.93	1.98	2.06	2.05		1.99
Unit weight of "ideal" nut Pounds		2.10	1.89	1.98	2.03	0.36 "Z" not significant	1.94	1.99	1.98	2.18	0.13 0.11 "Z" not significant	2.00

Estate D.

		Cover slashed	Cover buried	Clean weeded & cultivated	Clean weeded only	Minimum difference for significance	N P K	L N P K	Lime	Control	Minimum difference for significance	General Mean
No. of nuts	Percentage of General Mean	93.7	86.5	107.5	112.5		93.3	97.8	99.4	109.6		
	Nuts per Palm	*15.6*	*14.4*	*17.9*	*18.8*		*15.6*	*16.3*	*16.6*	*18.2*		*16.7*
Weight of nuts.	Percentage of General Mean	93.0	84.0	113.1	109.3		91.2	98.4	102.8	108.7		
	Pounds per Palm	*28.8*	*25.8*	*34.7*	*35.5*		*27.7*	*30.2*	*31.6*	*33.4*		*30.8*
Unit weight of nut. Pounds Derived from Means		1.84	1.79	1.94	1.87		1.77	1.86	1.90	1.89		1.84
Unit weight of "ideal" nut Pounds		1.86	1.78	1.95	1.79	0.33 "Z" not significant	1.77	1.87	1.92	1.83	0.15 0.13 "Z" not significant	1.85

Estate E.

		Cover slashed	Cover buried	Clean weeded & cultivated	Clean weeded only	Minimum difference for significance	N P K	L N P K	Lime	Control	Minimum difference for significance	General Mean
No. of nuts	Percentage of General Mean	104.6	89.0	105.3	101.2		97.9	108.1	96.1	98.1		
	Nuts per Palm	*17.9*	*15.2*	*17.9*	*17.2*		*16.7*	*18.3*	*16.3*	*16.7*		*17.1*
Weight of nuts.	Percentage of General Mean	109.1	88.9	104.5	97.6		97.5	104.8	95.6	101.6		
	Pounds per Palm	*41.7*	*34.3*	*40.4*	*37.4*		*37.4*	*40.2*	*36.7*	*38.9*		*38.3*
Unit weight of nut. Pounds Derived from Means		2.33	2.25	2.24	2.18		2.24	2.20	2.26	2.32		*2.24*
Unit weight of "ideal" nut Pounds		Not calculated, differences small.										

Estate F.

		Cover slashed	Cover buried	Clean weeded & cultivated	Clean weeded only	Minimum difference for significance	N P K	L N P K	Lime	Control	Minimum difference for significance	General Mean
No. of nuts	Percentage of General Mean	91.8	81.5	129.0	98.4		100.8	97.6	109.6	91.9		
	Nuts per Palm	*10.8*	*9.7*	*15.3*	*11.7*		*11.9*	*11.6*	*13.0*	*10.9*		*11.9*
Weight of nuts.	Percentage of General Mean	96.6	81.0	125.4	96.9		96.5	101.3	112.5	89.3		
	Pounds per Palm	*26.1*	*21.9*	*33.8*	*26.1*		*26.0*	*27.3*	*30.3*	*24.1*		*27.0*
Unit weight of nut. Pounds	Derived from Means	2.39	2.25	2.21	2.23		2.18	2.35	2.33	2.21		2.27
Unit weight of "ideal" nut Pounds		2.43	2.25	2.21	2.23	0.57 "Z" not significant	2.18	2.41	2.37	2.19	0.181 .014 "Z" not significant	2.29

Estate G.

		Cover slashed	Cover buried	Clean weeded & cultivated	Clean weeded only	Minimum difference for significance	N P K	L N P K	Lime	Control	Minsmum difference for significance	General Mean
No. of nuts	Percentage of General Mean	97.0	100.8	97.1	105.2		100.8	96.4	101.2	101.7		
	Nuts per Palm	*12.9*	*13.4*	*12.9*	*13.9*		*13.4*	*12.8*	*13.4*	*13.1*		*13.3*
Weight of nuts.	Percentage of General Mean	93.4	101.0	106.2	99.3		104.2	98.2	98.5	99.3		
	Pounds per Palm	*35.4*	*38.3*	*40.3*	*37.7*		*39.6*	*37.2*	*37.4*	*37.7*		*37.9*
Unit weight of nut. Pounds	Derived from Means	2.74	2.89	2.96	2.90		3.00	2.84	2.79	2.88		2.81
Unit weight of "ideal" nut Pounds		2.74	2.76	2.84	2.81	0.41 "Z" not significant	2.80	2.90	2.74	2.72	0.23 0.18 "Z" not significant	2.79

Table VI.
Sub-means of Estate B.

	Cover Slashed		Cover buried		Clean weeded & Cultivated		Clean weeded	
	Percentage of General Mean	Nuts per palm	Percentage of General Mean	Nuts per palm	Percentage of General Mean	Nuts per palm	Percentage of General Mean	Nuts per palm
			1931					
N P K	100.7	*13.2*	85.4	*11.2*	59.2	*7.8*	100.0	*13.1*
L N P K	107.9	*14.1*	49.6	*6.5*	147.5	*19.3*	93.1	*12.2*
Lime	66.8	*8.8*	155.6	*20.4*	62.5	*8.2*	63.5	*8.3*
Control	73.5	*15.4*	179.0	*23.4*	125.5	*16.4*	130.3	*12.1*
			1933					
N P K	56.9	*21.6*	58.4	*22.2*	111.9	*42.6*	127.6	*48.5*
L N P K	74.5	*28.3*	73.0	*27.8*	182.3	*69.3*	150.7	*57.3*
Lime	47.8	*18.2*	100.3	*38.1*	110.5	*42.0*	136.4	*51.9*
Control	55.0	*15.5*	87.9	*33.4*	138.4	*52.6*	102.9	*39.1*
			First half 1934.					
N P K	78.6	*5.4*	43.0	*2.9*	106.0	*7.3*	161.7	*11.1*
L N P K	99.6	*6.8*	77.7	*5.3*	188.3	*12.9*	102.3	*7.0*
Lime	50.3	*3.4*	116.1	*7.9*	97.8	*6.7*	109.2	*7.5*
Control	60.3	*4.1*	77.7	*5.3*	128.9	*8.8*	101.5	*6.9*
			y-bx 1934/31.					
N P K	39.1	*15*	43.3	*16*	101.4	*38*	109.9	*42*
L N P K	55.5	*21*	72.1	*27*	156.2	*59*	134.3	*51*
Lime	36.0	*14*	72.8	*28*	99.4	*38*	125.2	*48*
Control	42.0	*16*	56.2	*21*	116.2	*44*	89.8	*34*

Z for interaction, *i.e.* differential response, is not significant.

Table VII

Giving Certain Values derived by Statistical Analysis.

		Surface Treatments	Manurial Treatments
		Estate A.	
Nut Counts 1931	Standard Deviation	13.0 %	24.2 %
Nut Counts 1933	S D	14.7	19.3
	Z r	0.51 (3.9 for significance)	0.52 (2.9 for significance)
$y\text{-}bx$ $\frac{33}{31}$	b	+ 0.61	+ 0.40
	S D	11.8	16.6
	Z r	0.27 (4.1 for significance)	2.6 (2.9 for significance)
1933 $\frac{\text{3 harvests}}{\text{12 harvests}}$	b	+ 0.92	+ 1.05
1933 Unit weight	S D	0.18	0.27
	Z r	1.01 (3.9 for significance)	1.95 (2.9 for significance)
		Estate B.	
Nut Counts 1931	S D	40.9	74.3
Nut Counts 1933	S D	21.8	27.8
	Z r	3.9	2.8
$y\text{-}bx$ $\frac{33}{31}$	b	+ 0.41	+ 0.22
	S D	10.6	22.8
	Z r	52.1	6.8
1933 $\frac{\text{3 harvests}}{\text{12 harvests}}$	b	+ 1.03	+ 1.05
1933 Unit weight	S D	0.23	0.24
	Z r	0.80	1.82
		Estate C.	
Nut Counts 1931	S D	3.9	11.3
	Z r	1.8	1.6

		Surface Treatments	Manurial Treatments
Nut Counts 1933	S D	4.6	15.7
	Z r	*4.8*	2.5
$y\text{-}bx = \frac{33}{31}$	b	+ 0.51	+ 0.91
	S D	3.9	11.4
	Z r	*5.2*	1.7
1933 $\frac{3 \text{ harvests}}{12 \text{ harvests}}$	b	+ 0.33	+ 1.20
1933 Unit weight	S D	0.21	0.18
	Z r	2.85	1.69
Estate D.			
Nut Counts 1931	S D	9.2	20.3
	Z r	2.02	0.82
Nut Counts 1933	S D	11.7	16.9
	Z r	1.66	1.09
$y\text{-}bx = \frac{33}{31}$	b	+ 0.64	+ 0.52
	S D	9.7	12.8
	Z r	2.62	1.74
1933 $\frac{3 \text{ harvests}}{12 \text{ harvests}}$	b	+ 1.01	+ 0.80
1933 Unit weight	S D	0.19	0.21
	Z r	1.90	1.41
Estate E.			
Nut Counts 1931	S D	11.2	
	Z r	0.39	
Nut Counts 1933	S D	9.0	15.2
	Z r	2.95	*2.6*
$y\text{-}bx = \frac{33}{31}$	b	+ 0.48	
	S D	6.8	not determined.
	Z r	*4.2*	

		Surface Treatments	Manurial Treatments
1933 $\frac{\text{3 harvests}}{\text{12 harvests}}$	b	+ 0.72	+ 0.70
1933 Unit weight	S D Z r	not determined.	
		Estate F.	
Nut Counts 1931	S D Z r	17.7 0.43	27.3 0.59
Nut Counts 1933	S D Z r	15.2 3.43	26.0 1.32
$y\text{-}bx$ $\frac{33}{31}$	b	+ 0.58	+ 0.60
	S D Z r	10.2 *6.26*	19.3 1.32
1933 $\frac{\text{3 harvests}}{\text{12 harvests}}$	b	+ 0.82	+ 0.79
1933 Unit weight	S D Z r	0.33 1.53	0.24 *4.12*
		Estate G.	
Nut Counts 1931	S D Z r	23.3 0.05	33.3 0.09
Nut Counts 1933	S D Z r	23.2 0.05	27.0 0.29
$y\text{-}bx$ $\frac{33}{31}$	b	+ 0.68	0.48
	S D Z r	14.2 0.28	21.3 0.65
1933 $\frac{\text{3 harvests}}{\text{12 harvests}}$	b	+ 1.28	+ 0.77
1933 Unit weight	S D Z r	0.23 0.53	0.31 1.16

THE RELATIONSHIP BETWEEN WEIGHTS OF COCONUTS, HUSKED NUTS AND "MEAT"

BY

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The reason for this investigation has been explained on the third page of the preceding paper in this number on Cultivation and Manuring of Coconuts; the work was carried out in 1932. In *Tropical Agriculturist* for February, 1934, the results of a similar investigation are given by Pieris.

Procedure.

In carrying out these investigations a total of 936 freshly collected coconuts from three estates have been weighed to the nearest gramme, individually, nut by nut; each coconut in turn was weighed, husked, weighed again, and split, after which the meaty tissue in the half nuts was gouged out and the pieces were carefully collected and weighed.

On the first estate, an area of healthy palms, 18 years old, yielding large nuts, was selected and from the crop, indiscriminately collected from the palms, only the fully ripe, brown nuts were selected for examination. In all 400 nuts were examined on this estate.

The same procedure was repeated on the second estate where a good yielding block was selected and 430 ripe brown nuts, indiscriminately collected from a block of palms 17 years old, were examined.

On the third estate, the procedure was varied. In this instance 106 coconuts, of mixed ripeness, collected from an area planted 32 years previously and yielding small nuts, were examined.

Finally, 100 husked nuts of mixed ripeness collected from various small holdings in the coastal district of Kuala Selangor were weighed, split and weighed again; after which the meat was extracted and weighed. The object in this instance was to ascertain whether nuts grown under a wide range of conditions would show a wider range of variability and whether it was necessary to split the husked nuts in order to rule out possible variation due to the amount of water contained in each nut.

The relevant figures are as follows:—

	Mean Weight grammes	*Standard Deviation*
First Estate (400 nuts)		
Fruit	1882	± 283
Husked nut	1227	± 236
Meat	515	± 81

	Mean Weight grammes	*Standard Deviation*
Coefficient of correlation		
$\frac{\text{Fruit}}{\text{Meat}}$	+ 0.767	
$\frac{\text{Husked Nut}}{\text{Meat}}$	+ 0.770	
Second Estate (430 nuts)		
Fruit	1809	± 289
Husked nut	1212	± 208
Meat	510	± 87
Coefficient of correlation		
$\frac{\text{Fruit}}{\text{Meat}}$	+ 0.704	
$\frac{\text{Husked Nut}}{\text{Meat}}$	+ 0.817	
Third Estate (106 nuts)		
Fruit	1783	± 258
Husked Nut	1114	± 197
Meat	467	± 61
Coefficient of correlation		
$\frac{\text{Fruit}}{\text{Meat}}$	+ 0.676	
$\frac{\text{Husked Nut}}{\text{Meat}}$	+ 0.762	
Kampong (100 nuts)		
Fruit	Not available	—
Nuts, husked	1081	± 187
Nuts, husked and split	734	± 107
Meat	464	± 79
Coefficient of correlation		
$\frac{\text{Nuts}}{\text{Meat}}$	+ 0.840	
$\frac{\text{Split Nuts}}{\text{Meat}}$	+ 879	

It will be seen that there is high correlation especially between weight of husked nut and meat and that the splitting of nuts is not essential.

NOTES ON THE OIL PALM IN MALAYA WITH SPECIAL REFERENCE TO FLORAL MORPHOLOGY

BY

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In preparation for a series of experiments in connexion with pollination of oil palms, notes were made on the general structure and habits of growth of the oil palm in Malaya; in particular, careful observations were made on the appearance and subsequent development of the male and female inflorescences including details of the morphology of male and female flowers and the development of the fruit.

The oil palms grown on estates in Malaya are of the "Deli" type (*Elaeis guineensis* var *communis*, forma * *dura*, *Becc.*) and it is with such palms that these observations and experiments are concerned.

The climate of Malaya, with an average annual rainfall of from 80 to over 100 inches and a mean daily temperature of about 80°F, provides very favourable conditions for the growth of oil palms (1) (2).

A member of the natural order Palmae, and closely related to the coconut palm, the oil palm, though at first somewhat slower in growth than the former, usually also attains considerable height. Some palms, however, form very thick stems with proportionately reduced upward growth.

The erect columnar stem, is usually between 18 inches and 24 inches in diameter and is said to be capable of reaching heights of between 50 and 100 feet. (2) (3) (4).

The average height of stems of 10 year old palms in local estates is about 10 feet, but apart from differences of type, heights of palms may vary a good deal according to the fertility of soil.

The palms are monoecious, and the usually unisexual inflorescences are produced in the axils of the leaves.

Palms usually come into bearing about the fourth year after planting, that is, when between four and five years old, and reach maturity between the tenth and twelth years.

From the seedling stage up to the age of about 5 years, the young palm has a very bush-like appearance with a large number of leaves on a stem which is still so short that the tips of the oldest leaves often touch the ground, as they hang outwards.

* The writer has not seen a copy of Beccari's work published in 1914, (13) but he is usually quoted as giving *dura* the importance of a "sub-variety". The above modification follows Janssen's use of "forme", (14) but with more limited application of his *forme dura*, and, is more correct, the writer thinks, in view of the parallel variation in thickness of shell in all varieties of *Elaeis*.

As the plam grows, it assumes a more typical appearance with pillar-like stem and a terminal crown of large elliptic, pinnate leaves. The youngest leaves in the centre of the crown are erect while the older leaves, in succession, hang further outwards all round, the oldest leaves hanging obliquely downwards.

The fresh leaves are dark green in colour and on mature palms are 16 to 22 feet long, including petiole.

The petioles are between 3 and 4 feet long, about 2 inches across at the distal end and widening downwards until greatly broadened at the base. They are tough, plano-convex in section, and are armed along both edges with short strong thorns, which at an earlier stage were the bases of the ribs of fibrous sheaths protecting the shoot.

It is very noticeable that palms differ as regards the colour of their petioles, some being green and some brown, while others are of an intermediate shade or shades.

Some investigators have found a correlation between green petioles and high yield (9) which has not been found locally.

The pinnae are attached to the rachis of the leaf in two slightly divergent ranks on each side; they are 1 to 2 inches wide and are 30 to 40 inches long at the widest part of the leaf, a little beyond half-way from the petiole to the tip, and successively shorter towards each end; and they are turned gradually more forwards or upwards towards the tip.

The pinnae on the right-hand side (facing the palm) of a mature leaf are usually an inch or so longer than the pinnae on the other side.

The time at which a young leaf commences to open out its laterally-compressed pinnae may be regarded as the occasion of its first appearance as a young leaf in the centre of the crown. (7).

Normally, leaves wither about 18 to 21 months from this first appearance, having become in that time the oldest leaves at the bottom of the crown and being no longer required by the palm.

In the particular case of a leaf subtending a fruit bunch, the leaf dies a month or two after the fruits have ripened.

Dead leaves, particularly when the palms are fairly young, do not readily fall away owing to the tough sheathing bases of the petioles adhering tenaciously to the stem, overlapping one another. They gradually wither and disintegrate, leaving a portion of the base of the petiole on the stem of the palm.

The usual practice on estates is to cut off all dead leaves, and any others immediately below or supporting a ripe bunch, in order to facilitate harvesting and inspection.

Excessive pruning or damage to leaves, however, reduces the total area of leaf surface and therefore curtails the supply of carbohydrate food material which is formed in the leaves by the assimilation of carbon dioxide from the air. This has an adverse effect on the development of fruit bunches. It also has the effect of accelerating the production of young leaves, which causes an

increased rate of growth in height, necessarily at the expense of the girth of the stem then being formed. It thus causes attenuation of the stem, as well as a reduction in the reserves and the strength of the palm, from the effects of which it may not quickly recover, especially if the palm is immature. (10).

From the age of about 10 years the palm has a crown of from 30 to 50 leaves with a spread of from 25 to 30 feet in diameter and produces from 18 to 30 new leaves per annum, in either clockwise or anti-clockwise direction, more usually the latter, at intervals of approximately 137° so that eight oblique series of leaves are formed up the stem of the palm. (3) (5).

In the axils of between 60 and 70 per cent. of the leaves mature male or female inflorescences are developed, (6) while aborted inflorescence buds are sometimes found, on dissection, between the stem and the closely adpressed bases of the petioles of other leaves, and it is not unreasonable to assume that a potential inflorescence is formed in the axil of each leaf.

Inflorescences are developed excentrically in the axils of the leaves, lying either to the right or left according to the clockwise or anti-clockwise arrangement of the leaves, and protrude from the side of the base of the petiole.

Although oil palms are monoecious, they usually display mature inflorescences of only one sex at a time, and produce them in definite alternating phases which may be of equal or unequal lengths and numbers of inflorescences.

The alternating male and female phases are sometimes of about four months each, but they are not generally of this length nor of equal lengths for both sexes. Some palms produce inflorescences of one sex (rarely both) for periods of as long as twelve months or more. (11).

The lengths of these phases are usually fairly constant for individual palms but vary widely from palm to palm. Nevertheless, the total numbers of male and female inflorescences produced on an average stand of palms are approximately equal in an aggregate over sufficient length of time.

The proportions of male and female inflorescences per palm seem to be an expression of a definite genetical constitution, but the development and appearance of female inflorescences is probably governed to a considerable extent by the fertility of the soil and the amount of rainfall. (4).

At the time of change of phase, one or two inflorescences bearing both male and female spikes are sometimes found on a palm and it occasionally happens that the first inflorescences of a succeeding phase, though later in origin, may, by more rapid development, attain to maturity before the last inflorescences of the preceding phase. It also, apparently, happens that a series of inflorescences of one sex is followed by a single inflorescence of the other sex; then a single inflorescence of the first sex before; finally, it is followed by the series of inflorescences of the other sex.

It is very seldom, however, that a male inflorescence and female inflorescence are in flower together on the same palm.

The habit of overlapping appears, from present observations, to be typical of individual palms, but others have well defined male and female phases.

From the above observations, it will be realised that cross-pollination is the normal means of securing fertilisation, but that self-pollination, though probably very rare, is also possible. It is, at any rate, capable of producing viable seed, but whether it has an adverse effect on resulting progeny is as yet undetermined. Seedlings of controlled "selfings" are now being planted out for experimental purposes.

Floral Morphology.

As has been mentioned, the inflorescences are produced in the axils of the leaves, but their presence is not apparent until the apex of the inflorescence emerges above the base of the leaf petiole; at first the inflorescences are each enclosed in two spathes or sheathing bracts, the outer of which bursts about a month after it has fully emerged above the base of the petiole, while the inner sheath elongates with the inflorescence and splits, on an average, 16 days after the bursting of the first sheath, on a female inflorescence, and 20 days after, in the case of a male inflorescence.

From this point, the female infloresence usually takes longer than the male to reach maturity, but they both commence flowering in all at about 40 days from the bursting of the first sheath.

The Female Inflorescence.

The young female inflorescence continues to expand after splitting the inner sheath until it is a large oval "head" of about 12 inches long by 8 inches wide and 6 inches deep with between 100 and 200 spikes, bearing sessile female flowers and arising in spiral arrangement from a short central axis. The female flowers are fairly widely spaced along the spikes, the apices of which form large tough spines. Between 3,000 and 6,000 flowers are carried on the whole inflorescence.

The stalk of the inflorescence, arising in the axil of the leaf, is oval in section, being somewhat compressed between the base of the petiole and the stem of the palm, and is from 7 to 9 inches in girth. It is 10 to 12 inches long, but only about half of this is conspicuous above the base of the petiole. The female inflorescence is therefore not much elevated, and the fibrous remains of the inner sheath more or less encumber the base of the female inflorescence, thereby covering some of the lower-placed flowers and making them almost inaccessible to the wind-borne pollen.

An inflorescence protruding from one side or the other of the petiole of the subtending leaf, rests, when fully expanded, on the petiole of an older leaf in the next series. This petiole, later, provides necessary support for the bunch when weighted with fruits.

Each female flower is slightly sunk in the axis of the spike and is protected by a bract, the apex of which is sharp and thorn-like. These bracts are firmly

connected to the central axis and each is united with the adjoining bracts, so that a continuous shield is formed for the flowers on each spike.

The flower is about 14 mm. long by 8 mm. in diameter and consists of a large, syncarpous, tricarpellary ovary with a deeply divided trifid stigma on a very short style; a rudimentary staminal disc; three petals; three alternating sepals and two or three bracteoles. The petals, sepals and bracteoles are all sub-coriacious and scale-like and enlarge with the developing fruit. Very rarely flowers with four perfect carpels are found.

During development of the flower, two bracteoles usually each split off one wing which becomes separated from the main portion by a distance of about a third of the circumference of the flower base, and develops as a thin rod of tissue.

The three stigma lobes are thick and fleshy and white, about 6 mm. long when mature, and triangular in section, fitting closely together when immature. Each lobe has, along its inner angle, a very fine and fairly deep grove, on both sides of which are small glandular hairs; often one side, usually the left, is more hairy than the other. (8).

At maturity, and when the stigmas have pushed their way out of the enclosing perianth and are receptive, these lobes bend outwards, exposing the hairy inner angles for retention of pollen.

As the flowers become receptive, their temperature rises considerably and they give off a mild scent of aniseed, which seems to come most distinctly from between the bases of the lobes of the stigmas. At the same time, there is exudation of moisture along the grooved inner edge of each lobe. The secretion of moisture along the stigma lobes at receptivity is a not uncommon phenomenon in wind-pollinated flowers, and helps in the retention and rapid germination of the pollen grain.

The day after the flowers have fully matured, the tips of the stigma lobes turn pink and the colour spreads and deepens as the period of receptivity passes, until, soon after this is over, the whole stigma is deep purple in colour and is drying up.

The female inflorescence is in flower for four or five days with the majority of flowers opening on the first and second days, but the period of receptivity of individual flowers has been recorded as lasting for three days. (12).

The ovary of the female flower has, normally, three ovules of which, usually, one is fertilised and develops into a seed, while the other two atrophy. Occasionally, however, two, and more rarely three, seeds are formed.

After fertilisation of the ovum and the secondary nucleus in the embryo sac of the ovule, the normal cytological development takes place and the ovule eventually develops to form the egg-shaped seed, consisting of a comparatively thin seed coat and a solid kernel, which in turn comprises a viable embryo and a quantity of reserve food material or endosperm.

The stimulus following fertilisation is carried to the walls of the carpels and they develop to form a protective coat or pericarp, of which the inner portions or endocarp, becoming cemented with stone cells, form a very hard shell which surrounds the seed, while the outer layer or exocarp becomes succulent and oil-containing.

When two or three seeds are developed they remain entirely separated from each other, being individually surrounded by the hardened endocarp of their respective carpels.

In the apical portion of the shell there are three germination pores corresponding to the three carpels of the ovary, and directly above the embryos of the seeds within.

In the normal case, where only one seed is formed, two small flattened cavities can be found in the shell immediately below two of these germination pores, marking the relics of the two atrophied ovules.

The respective proportions of the whole ripe fruit are as follows:—

Exocarp or "pericarp" from 50 to 70 per cent.

Endocarp or shell from 20 to 40 per cent. and

seed or "kernel" from 3 to 13 per cent.

The shell of the "dura" form is from 2 mm. to 5 mm. thick. (3) (15).

A bunch of ripe fruit may weigh from a few lbs. up to 150 lbs. or so, according to the number of flowers successfully pollinated and to the fertility of the soil.

An average good bunch weighs from 30 to 40 lbs. and contains from 800 to 1,000 fruits in a large head armed with the more or less protuding spine-like apices of the numerous spikes.

When ripe, the fruits on the lower parts of the spikes, hidden inside the bunch, are bright orange in colour and are compressed into various angular shapes; the fruits on the outside, nearer the tops of the spikes, are larger and somewhat pear-like in form. These are generally 1½ to 2 inches in length and 1 to 1½ inches in diameter; full and round and of a dark brownish purple colour, with a bright orange and slightly angular compressed base.

The Male Inflorescence.

The male inflorescence, after bursting the inner sheath, grows further out and displays a panicle of finger-like spikes radiating from the central axis. On an average, there are about 100 fingers or spikes in each inflorescence. There are from 900 to 1,500 flowers on each spike, densely crowded, in a left to right spiral arrangement, forming a smooth, cylindrical or slightly club-shaped "finger" of about 6 to 8 inches long and ½ to ¾ of an inch in diameter.

The stalk of the male inflorescence is longer than that of the female, being from 15 to 18 inches in length, so that the mature male inflorescence is raised prominently above the base of the petiole and fairly well exposed.

The male flowers which are much smaller than the female, being about 4 mm. long by 2 mm. broad, have six stamens with large bilobed anthers dorsifixed on short filaments, which are united at the base to form a thick cup-like disc, surrounding a degenerate ovary with much reduced stigma. The stamens are enclosed by three scale-like petals and three almost similar sepals.

Each flower is sunk in the fleshy axis of the spike and protected by a bract which ends in a small hardened point. These bracts are united with the axis of the spike and with each other, forming a perforated sheath for the flowers, in like manner to that formed by the bracts on spikes of female inflorescences, but enveloping the flowers more completely.

The axes of the spikes of male inflorescences form at their apices tough, short spines, much less formidable than those of the spikes of female inflorescences.

When the flowers are mature, the staminal disc grows to form a tube, finally much more than half the height of the thus lengthened stamens, which emerge from the bractical envelope, bending outwards, so that the anthers eventually face upwards in star-shaped arrangement. The anthers open along the outwardly inclined inner edges of the lobes, and when fully open, expose a vast amount of pollen over the whole inflorescence.

The pollen is pale yellow in colour in bulk, is dry, and smells strongly of aniseed while fresh. The individual grains are tetrahedral in form with one face larger than the others, making a regular pyramid, the height of which is equal to, approximately, half the length of one of the sides of the triangular base, the sides of which are 35 μ in length. Very rarely pentahedral pollen grains are found, with a square base and four pyramidal sides.

Raphides of calcium oxalate in fairly large numbers are found amongst the pollen grains; they are probably a final product of metabolism accompanying the ripening of the anthers, and appear to be functionless.

Male inflorescences are in flower for about five days with most of the flowers opening on the second and third days.

It has been recorded in Sumatra that female flowers commence to open at about 4 a.m. No records of this nature have been made in this instance, but it has been noticed that flowers on male inflorescences often open between midnight and 2 a.m.

A few notes have been made on insect visitors but these will be included in a second article on means of pollination.

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CONDITIONS ON SMALL RUBBER HOLDINGS IN MALAYA.

3rd Quarter, 1934.

Prepared by the Economics Branch of the Department of Agriculture, Straits Settlements and Federated Malay States, in collaboration with the Field Branch of the Department.

Rainfall.

In the north of the Peninsula heavy rains were experienced throughout the quarter, flooding being general in all districts of Province Wellesley and Penang in September.

Rainfall was normal for the time of year in most other parts of the country. In North Johore dry weather continued throughout the quarter and in Negri Sembilan weather conditions were generally dry during July and August. Heavy rainfall was experienced throughout Malaya in September.

Prices.

There was a continued steady improvement in the prices paid for smallholders' rubber during the quarter under review, not so marked, however, in September when prices tended to remain at the August level.

Table I shews the lowest and highest prices at which rubber was purchased by dealers in each State. It will be noticed that although in a few cases there is a considerable difference between the extremes, the variation, on the whole, is within narrower limits than earlier in the year.

An additional table (II) is again given, shewing the mean of lowest and highest prices paid at a number of centres in each State during the quarter.

Sales of scrap rubber remained small, as noticed in the report of the second quarter, but in Kedah unfavourable climatic conditions led to larger quantities being sold in some places.

Tapping.

Tapping systems generally have taken a more conservative trend since the introduction of restriction; and in the case of Malay holdings in many areas, the preparation and planting of padi fields have prevented excessive tapping.

Owing to wet weather in Kedah, excessive tapping took place when days were fairly fine; some improvement in tapping methods was observed in South Kedah as a result of the work of the newly appointed Asiatic Rubber Instructor. In the Muar District of Johore it was reported that, since the advent of rubber regulation, several holdings of immature rubber had been brought into tapping earlier than advisable, the owners desiring to obtain a coupon allowance for such holdings.

Table I.

Lowest and Highest Rubber Prices Paid by Local Rubber Dealers.

(In Straits dollars per picul (133 1/3 lbs.))

3rd Quarter 1934.

	Penang	Perak	Selangor	Negri Sembilan	Pahang	Malacca	Kedah	Johore
			JULY					
Smoked sheet	24.50-29.00	24.00-29.00	25.50-30.30	24.00-30.00	23.00-30.00	26.00-30.00	25.00-29.00	24.00-30.00
Unsmoked sheet	21.50-28.00	22.00-27.00	12.00-27.00	22.00-28.00	19.00-28.20	24.00-28.00	20.00-27.80	20.00-29.00
Scrap	—	6.00-12.00	6.00-17.00	—	—	16.00-17.00	10.00-14.00	†1.50-11.00
			AUGUST					
Smoked sheet	26.00-31.00	25.00-31.83	26.00-32.00	27.00-32.00	21.70-31.60	27.00-31.00	28.00-30.50	24.00-31.00
Unsmoked sheet	23.00-29.50	24.00-28.50	20.00-27.40	24.00-29.50	19.50-29.50	25.00-30.00	25.00-29.00	21.00-29.50
Scrap	—	8.00-15.00	13.00-20.00	—	—	15.00-17.00	12.00-15.00	†2.00-16.00
			SEPTEMBER					
Smoked sheet	27.00-32.00	23.15-31.83	28.00-32.00	27.00-32.00	23.00-31.60	28.00-31.00	28.00-31.00	27.00-31.50
Unsmoked sheet	25.00-30.00	24.50-29.00	25.00-28.00	25.00-30.00	18.50-29.50	27.00-30.00	24.00-29.50	23.00-29.80
Scrap	4.00-16.00	9.00-15.50	14.00-18.00	12.00-17.00	11.50*	14.00-18.00	5.50-15.00	†2.00-17.50

*at one centre only.
†$1.50 and $2 at one centre only.

Table II.

Mean of Lowest and Highest Rubber Prices Paid by Local Dealers at a number of Centres in each State.

(In Straits dollars per picul (133 1/3 lbs.))

3rd Quarter 1934.

	Penang	Perak	Selangor	Negri Sembilan	Pahang	Malacca	Kedah	Johore
				JULY				
Smoked sheet	26.50-28.50	26.30-27.84	25.93-27.83	26.10-29.38	24.62-28.70	26.66-29.00	26.25-28.50	25.50-27.55
Unsmoked sheet	24.20-27.10	23.76-25.72	21.75-24.00	23.83-27.25	22.72-27.24	24.66-27.00	23.75-26.70	22.75-25.75
Scrap	—	6.00-12.00	10.00-12.50	—	—	16.00-17.00	11.00-13.00	5.75-6.50
				AUGUST				
Smoked sheet	28.12-29.63	28.01-29.86	27.75-34.48	28.10-30.85	25.53-30.05	27.66-30.33	28.38-29.63	27.15-29.22
Unsmoked sheet	26.10-28.10	25.58-27.30	23.83-25.80	26.08-28.66	23.56-28.16	25.66-28.66	26.00-27.25	25.17-27.67
Scrap	—	8.00-15.00	13.50-18.00	—	—	15.00-17.00	13.25-14.25	10.43-12 53
				SEPTEMBER				
Smoked sheet	28.25-30.25	28.54-30.60	28.58-30.67	28.50-31.50	26.13-30.58	28.66-30.33	29.38-30.75	28.32-29.02
Unsmoked sheet	26.60-28.70	26.42-28.00	25.75-27.70	26.33-29.16	23.60-28.76	27.00-29.33	26.63-28.50	25.57-28.04
Scrap	8.00-10.00	9.00-15.50	14.33-16.33	12.47-15.33	11.50*	15.33-16.66	11.00-12.88	10.94-13.12

*at one centre only.

Areas out of Tapping.

Estimates of areas untapped on small holdings were again obtained by counting the number of such areas and applying the percentage thus obtained to the total area of small holdings in the District.

Table III shews the results of the survey in September, and it will be seen that more areas have come into tapping again as conditions under rubber regulation became more stable.

The total of areas out of tapping on estates of less than 100 acres in the Federated Malay States, as at the end of September 1934, was estimated by the above system to be 42,600 acres as compared with 54,600 acres at the end of June. The total area untapped in the Straits Settlements at the end of the period under review was 13,900 acres as compared with 18,800 at the end of June. The relative figures for March, when rumours of restriction led to excessive tapping, were 34,950 acres and 9,900 acres in the Federated Malay States and Straits Settlements respectively.

Condition of Holdings.

Reports indicate that the very marked improvement in the condition of small holdings in all States has been maintained. In Krian 640 trees were lost in two areas during the storms and floods experienced in the first week of September. In the Kuala Langat District of Selangor, a number of Malay-owned smoke houses have been improved in order to better the quality of rubber produced. In the same District two new smoke houses of approved design have been constructed by Malays under the guidance of the Asiatic Rubber Instructor.

Diseases.

In Kedah, bark diseases again became very prevalent owing to the wet weather; disinfectants were extensively used for their treatment.

Mouldy rot remains the most prevalent disease in nearly all States, but it is generally kept well under control and wide use is made of approved fungicides available from the Department. In Johore an improvement is reported owing to weather conditions being unfavourable to the development of the disease. In the Krian and Selama Districts of Perak the heavy rains of August and September resulted in a marked recrudescence of the disease, further accentuated by the lack of attention given to holdings by their owners due to the incidence of padi planting operations.

A serious outbreak of pink disease was reported from Pahang and control treatment was being undertaken; a few cases were observed in Perak Central.

A sporadic outbreak of *Oidium Heveæ* occurred in the Segamat District of Johore in July and was still in evidence during August and September when weather conditions were favourable to the spread of the disease. An outbreak of the disease was also reported in Selangor.

Cases of root diseases were rather frequent in Perak Central, but the damage occasioned was not extensive.

Table III.

Estimated Acreage of Tappable Rubber which was out of Tapping on Holdings of less than 100 Acres, at the end of September, 1934.

PERAK				SELANGOR				NEGRI SEMBILAN				PAHANG			
District	Total Tappable area	Total area untapped	Percentage	District	Total Tappable area	Total area untapped	Percentage	District	Total Tappable area	Total area untapped	Percentage	District	Total Tappable area	Total area untapped	Percentage
Batang Padang	37,288	2,600	7	Klang	18,879	1,300	7	Seremban	19,241	2,300	12	Raub	7,361	100	1
Kinta	34,180	1,400	4	Kuala Langat	29,263	1,500	5	Tampin	17,947	2,200	12	Kuala Lipis	15,951	2,200	14
Kuala Kangsar	43,485	1,600	7	Ulu Langat	38,867	2,400†	6	Kuala Pilah	17,470	2,800	16	Bentong	13,600	3,400	25
Upper Perak	13,774	1,500	11	Ulu Selangor	30,632	2,100	7	Jelebu	6,270	600	9	Other Districts	31,223	4,900	15
Larut & Selama	51,407	2,000	4	Kuala Lumpur	21,174			Port Dickson	10,653	500	5				
Krian	9,751	1,900	20	Kuala Selangor	9,379	1,900†	6								
Lower Perak	47,937	3,400	7*												
	237,822	14,400	6		148,194	9,200	6		71,581	8,400	12		68,135	10,600	15

MALACCA				PENANG & P. WELLESLEY				SINGAPORE			
District	Total Tappable area	Total area untapped	Percentage	District	Total Tappable area	Total area untapped	Percentage	District	Total Tappable area	Total area untapped	Percentage
Central	17,687	1,900	11	North	3,241	400	11	Singapore	12,781	400	3
Alor Gajah	31,387	4,700	15	Central	7,067	1,000	14				
Jasin	24,971	1,500	6	South	8,149	100	1				
				Dindings	7,279	2,800	39				
				Penang	11,114	1,100	10				
	74,045	8,100	11		36,850	5,400	15		12,781	400	3

The percentage of areas out of tapping in June, 1934, was as follows:—Perak 10, Selangor 10, the Negri Sembilan 15, Pahang 14, Malacca 14, Penang and Province Wellesley 20, Singapore 8.

* Estimated from percentage for Kuala Kangsar.

† Estimated from percentage for other Districts in the State.

Grades of Rubber.

The variation in the grades of rubber purchased by dealers was again considerable and separate figures for the various States are given as a more exact guide to the position. The absence of scrap from such figures is particularly noticeable.

Kedah.—The percentage of smoked sheet increased during the quarter, the increase being considerable in certain Districts. Unsmoked sheet decreased in most Districts but increased in the Kulim District and the production of scrap was negligible throughout the State. Average percentages were :—Alor Star : smoked sheet 80, unsmoked 12, scrap 8; Kuala Muda : smoked sheet 48.5, unsmoked 44.5, scrap 7; South Kedah : smoked sheet 54, unsmoked 40, scrap 6; Baling : smoked sheet 82, unsmoked 16, scrap 2.

Johore.—In this State also the tendency was to an increase of smoked sheet, the percentages in Muar, Batu Pahat and Tangkak being respectively 67, 80 and 88. In Panchor, Senggarang, Kukup and Pontian, the reverse was the case, almost the entire purchases being of unsmoked sheet. The percentage of scrap sold was negligible with the exception of Batu Pahat, Johore Bahru and Kota Tinggi, 15 per cent., and Segamat, 10 per cent.

Perak.—In the District of Krian and Selama Sub-district the closed market for scrap resulted in an increased amount of sheet rubber being manufactured. The percentages were :—Krian : smoked 30, unsmoked 70; Selama : smoked 80, unsmoked 20.

In Perak North, smoked sheet increased to 77 per cent. in Taiping, but only in Trong was there any other considerable amount of this grade purchased (45 per cent.). In Perak South, with the exception of Tanjong Malim (smoked 100) Chenderian (smoked 52) and Slim Village (smoked 52) the average percentages of purchases at seven centres were : smoked 19, unsmoked 81.

In Perak Central the percentage purchases were : smoked sheet 60, unsmoked 33, scrap 7.

Selangor.—Percentage figures are not available but reports state that smoked sheet was generally made in the coastal districts and both smoked and unsmoked sheet in the inland districts.

Penang, Province Wellesley and Dindings.—In Penang, sales were entirely of unsmoked sheet; in Province Wellesley also, sales were principally of unsmoked sheet, though at three centres in the Central Circle sales were entirely of smoked sheet. In the Dindings percentage purchases were :—smoked sheet 53, unsmoked 44.5, scrap 2.5.

Malacca.—The percentages of purchases were as follows :—Central : smoked sheet 66, unsmoked 17, scrap 17; Alor Gajah : unsmoked 91, scrap 9; Jasin : smoked sheet 29, unsmoked 66, scrap 5.

Negri Sembilan.—Considerable variation in the percentage of grades sold is noticeable as in the foregoing States; sales of scrap are only taken into account in the Rembau District. In the Seremban District the average percent-

age of smoked sheet was 83; in the Kuala Pilah District, average percentages for five centres were: smoked sheet 42, unsmoked 58. In the Rembau District purchases were entirely of unsmoked sheet with the exception of an average of 7 per cent. of scrap. The average percentages for the Jelebu District were: smoked sheet 60, unsmoked 40; whereas in the Port Dickson District the percentages were exactly reversed.

General.

No cases of budding of rubber were reported during the quarter and new plantings were prohibited under the rubber regulations. A few areas in Kedah were replanted and it was reported that 530 acres in Negri Sembilan had newly been brought into tapping. There was no indication of any areas being abandoned in favour of other crops.

Reports from Pahang state that many Malays in the riverine mukims of Lipis now combine and send their rubber to the nearest big town in preference to selling at lower prices to the small local dealers.

The position of the small-holder has undoubtedly improved as a result of rubber regulation and the only cases of hardship now found are those where small holdings have been leased at low rates during the depression.

The result of the work of the newly appointed Asiatic Rubber Instructors is already to be seen in an improvement in the quality of rubber produced.

Abstract.

AGRICULTURAL DEVELOPMENT IN JOHORE.*

General.

In point of size, Johore is the third largest administrative unit in the Peninsula, being exceeded only by Pahang and Perak. The total area is stated to be 7,670 square miles, or 4,908,800 acres. Of this, it is roughly estimated that 1,160,000 acres are under cultivation.

The area in acres under different crops in the State at the end of 1932 was approximately as follows:—rubber 854,700, coconuts 165,100, pineapples 39,300, oil palms 27,800, rice 19,300, tapioca 17,300, arecanuts 10,000, mixed fruits 8,000, coffee 4,600, bananas 6,000, derris (tuba) 1,800, gambier 1,700, tobacco 1,400, sago 1,200, other minor crops 1,000.

Johore has thus the largest cultivated area of each of the major crops grown in any one administrative unit in the country except rice, *viz.*—rubber, coconuts, pineapples and oil palms, while there is no crop of any importance grown in Malaya which is not cultivated.

This outstanding position is of comparatively recent growth and has been achieved very largely during the post-war period 1919—1930. Actual figures for areas under cultivation in Johore during earlier years are difficult to obtain and unreliable; there is, however, no doubt that development has been phenomenally rapid, and there seem to be grounds for believing that the cultivated area has very nearly doubled during the past ten years.

Johore differs from other parts of the Malay Peninsula in that it contains no central mountain chain and consists mainly of level plains and gently undulating country. It is thus peculiarly favourably situated for development. The policy of opening up the country by means of roads and railway has facilitated development and in consequence, population and capital have flowed in at a rapid rate.

The census figures are illuminating in this connexion. According to the 1931 census, the total population of the State in that year was 505,000, while at present it is estimated to be 545,000; in 1921 it was 282,000 and in 1911 180,000, the percentage increases in the two decades being:—1911—1921, 56.4 per cent., 1921—1931, 79.0 per cent.

A considerable proportion of the increase is accounted for by immigration from countries outside Malaya, the census returns shewing that between 1921 and 1931 the nett immigration amounted to 125,000 persons, or roughly 25 per

* Abstract of the Report on Agricultural Development in Johore by H. A. Tempany, C.B.E., D.SC., F.I.C., F.C.S., Director of Agriculture, Straits Settlements and Federated Malay States. Government Printing Office, Johore Bahru. 1934.

cent. of the total population, while 285,000 persons, or 56.6 per cent. of the population are foreign born. As the great bulk of the population is engaged in agriculture, its increase serves as an index of agricultural development. The total population comprises 234,000 Malaysians, 215,000 Chinese, 51,000 Indians, 700 Europeans, and 4,300 others.

Of the immigrant population, the Indians are mainly engaged as estate labourers; of the remainder, both Chinese and Malaysians are largely small-holders; they are industrious and thrifty and they are, for the most part, fairly skilled agriculturists; they are, in consequence, an addition to the population peculiarly favourable to development.

As elsewhere in Malaya, cultivation is divided between estates owned by Europeans and Asiatic capitalists, and small holdings.

Estate* agriculture is mainly confined to two crops, *viz.*—rubber and oil palms, but there must also be included about 11,000 acres of pineapples grown on estate or semi-estate lines as a main crop; uncertain areas of tapioca and gambier are being grown in the same way.

It is computed that about 510,000 acres represent what may be definitely termed estate cultivation, of which 469,000 acres are under rubber and 27,000 acres under oil palms.

The nationality of ownership of estates in Johore has been estimated to be as follows:—European 278,000 acres, Chinese 16,000 acres, Japanese 54,000 acres, Indian 14,000 acres, Malay 3,000 acres, other Asiatic races 1,000 acres.

It is noteworthy that in Johore, coconuts—which elsewhere in Malaya constitute a not unimportant estate crop—are grown exclusively in small holdings.

The area of small holdings in Johore is roughly 600,000 acres. It is clear, therefore, that the welfare of the small-holder must have a very particular significance for the Johore administration in as much as the prosperity of the State is so largely bound up therein.

Agricultural Policy in Johore.

Between the years 1921 and 1930, the tendency in Johore was towards rapid agricultural expansion; with the advent of the depression there has been a change. The cessation of alienation of land for rubber planting has been accompanied by an increasing determination on the part of the Government to ensure that the agricultural land of the State, which constitutes its chief natural asset, should not be wastefully exploited; at the same time, vigorous efforts are being made to achieve an accurate and complete system of land records and to correct any omissions and errors which may have occurred in the preceding period. Concurrently with these efforts, the extension and improvement of the agricultural services require attention.

* An estate is defined as a planted area of not less than 100 acres.

The Agricultural Requirements of Johore.

In Johore, with its very large agricultural development and particularly its large peasant proprietary, there is obviously need for efficient agricultural services. Those responsible for the larger and more efficiently managed properties are in a position to make their wants known. In the case of the rubber industry these facilities already exist in the Rubber Research Institute, the officers of which are available for advice, visits and work on the spot whenever the need is indicated. In relation to other industries the position is somewhat different; the services of the research branch of the Department of Agriculture, S.S. and F.M.S., are to a certain extent available, but visits can ony be paid by specialist scientific officers at the request of the State Government and on payment of the full salary and allowances of any officer so sent.

With the development of the pineapple industry and possibly the tapioca, gambier, and tuba industries, into main-crop cultivations, the need for specialist advice is certain to become increasingly felt. Obviously, both planters and Government should have access to readily available and efficient advice and guidance and planters should be encouraged to utilise freely all assistance which can be rendered.

In relation to peasant industries the needs are more complex. The peasantry is usually not only unable effectively to express its needs, but also unable to realise fully what its needs really are; consequently, it cannot take steps to fulfil them, alone and unaided. Unless, therefore, Government is prepared to assist peasants by providing sound and practical advice and help, it is impossible to expect rapid development.

Necessary preliminaries to this form of assistance are a study of conditions and research work correlated to the requirements of the population. An example of this is to be found in the work carried out in the past four years in the Federated Malay States and Straits Settlements in relation to the improvement of copra. Other subjects which require consideration are concerned with the control of plant diseases, the marketing of peasant produce, and the provision for systematic training in agriculture for the younger generation of peasant cultivators.

The problems affecting particular agricultural industries in Johore are dealt with in some detail. The following account epitomises some of the more salient points.

The Rubber Industry.

The requirements of the estate section of the industry are more or less adequately catered for at present by the Rubber Research Institute of Malaya. The inauguration of a trained staff of Asiatic Rubber Instructors, which has now been approved, will enable small-holders to obtain more readily the advantages of the expert advice of the Institute. When this service has been organised, numerous problems will require to be considered and a definite programme of work will require to be drawn up. Amongst these will be attention

to disease and demonstration of the proper methods of dealing with it, attention to improvements in the preparation of smoked and unsmoked sheet, attention to tapping systems and possibly assistance in marketing the product.

Coconuts.

The very large area of coconuts contained in small holdings represents no less than one-fourth of the total area under this crop in Malaya.

The general lay-out of the area does credit to the skill and industry of the owners. The regular planting, admirable systems of drainage and general appearance of the plantations is superior to the majority of native holdings elsewhere in Malaya. One is struck by the freedom from disease, and concludes that the owners have been quick to see the advantage of such measures of control as are recommended by the Department of Agriculture, for by repressive measures alone such a result could hardly have been attained.

The copra is in the hands of Chinese and sometimes Javanese buyers. It is of poor quality and made on somewhat primitive kilns.

The situation calls for improvements in the methods of copra manufacture and organised selling. This will necessitate careful watching and supervision, and assistance will almost certainly be required in marketing, as without informed work in this direction also, experience has shewn that much of the profit that can be realised may be lost. Attention is directed to the copra work already achieved by the Department of Agriculture. The extension of this work to Johore is suggested.

Oil Palms.

Johore now possesses the largest area under this crop in any one State, *viz.* 30,000 acres. It is contained on six estates. The largest property has already 10,000 acres planted, and reserves of a further 15,000 acres. There are three factories at present working, and a fourth will shortly be erected. One of these factories is the largest and most up-to-date of its kind in Malaya, if not in the world.

The industry is a new one, and like all new industries, presents many problems requiring solution, comprising both problems of agriculture and problems of manufacture, the latter process being more than ordinarily complicated.

For the solution of these problems, readily available scientific advice and assistance are requisite, and it is essential in the interests of the industry and of the State that owners who have embarked much capital in these undertakings, should be able to call in such assistance whenever required.

It is clear that the very large amount of work which has been done on these problems by the Department of Agriculture has directly benefitted the industry, and there are good grounds for Johore supporting this scientific work and taking full advantage of the existing facilities.

Pineapples.

The pineapple industry is of peculiar interest to Johore at present, both on account of its extent and nature, and also in view of the fact that it is undergoing a transition from that of a catch crop grown between young rubber to that of a main crop.

The Malayan industry is the second largest in the world; it has an assured market, and the crop can be grown under as favourable conditions as anywhere in the world. Is is essential that the industry should be retained, but the present position is full of difficulty and danger. The industry is worked on the basis of supplying a demand for a cheap product. The period which has been put to its existence as a catch crop necessitates a sharp change in agricultural methods, and if it is to survive as a main crop, regular manuring and efficient cultivation must replace the formerly prevalent methods which were of little importance at a time when it was a question of planting as a catch crop between young rubber, but which can bring about the ruin of large tracts of land if the attempt is made to apply them to the cultivation of the fruit as a main crop.

Fortunately the needs of the situation have to an extent been foreseen and the establishment of the Pineapple Experiment Station in Singapore, to which Johore contributes one-third of the upkeep, has furnished the means of giving definite information as to the manurial requirements of the pineapple crop.

It is very desirable, by control of quality and regulation of supply, to endeavour to maintain a price which will allow a reasonable profit to producers. The legislation which has recently been passed in the Colony of the Straits Settlements and in Johore, should assist in this direction, while the work now being carried out in the Singapore Station on the experimental shipment of graded pines should also prove of value.

Concurrently, the improvement of working conditions and methods in factories and of market organisation needs attention.

The industry is handicapped by lack of attention to the quality of the produce, by destructive competition in selling, by old fashioned methods of manufacture, and in some cases, by unsatisfactory manufacturing conditions. It is, moreover, seriously threatened by the competition of other countries.

Factory conditions have much improved of late, but conditions under which the operations are conducted remain rather primitive, and the methods of canning and processing are still antiquated and out of date.

By systematic research, propaganda and organisation, the industry can be modernised and stabilised, but for this, considerable efforts and adequate resources are necessary.

Tapioca.

The position in relation to tapioca is not dissimilar to that of the pineapple industry. In Johore, tapioca has been extensively cultivated as a catch crop between young rubber, and an industry has grown up, the existence of which is threatened owing to the need for its conversion from a catch crop to a main crop basis.

Like many other products, Malayan tapioca does not attain the highest standard of quality and cannot compete in this respect with the Javanese product; it seems very probable that if the product could be brought up to the level of the Javanese, it could displace the latter in the markets of the United Kingdom.

In Malaya the crop is largely confined to Johore, which is by far the largest producer. If, as in the case of pineapples, it can be successfully converted from a catch crop to a main crop basis, a valuable industry will have been firmly established in the State; if not, a useful asset is likely to become lost.

The crop makes appreciable demands on the soil, but not more so than many others, and the problem of it continuous cultivation is, just as with pineapples, that of devising an economic system of manuring and cultivation which will enable it to be cultivated continuously, or in rotation with other crops on the same land.

Sago.

This product can conveniently be mentioned at this point and although it can hardly be dignified with the name "crop" it is a not unimportant item of export from Johore. Nothing has so far been done towards investigating the problem of its possible evolution into a regular crop.

Gambier.

Gambier is a third example of a crop which has been grown fairly extensively in Johore as a catch crop between young rubber, and which is now faced with the alternatives of either conversion to a main crop or abandonment as an industry.

Information on this crop is available, but should be supplemented with further work in Johore itself.

Tuba Root.

This is a crop which gives promise of capacity for not inconsiderable extension. It is cultivated in Johore entirely as a catch crop, but the possibilities of its development as a main crop should not be overlooked.

The product is used as an insecticide. Work on varieties and their insecticidal properties, on cultivation and manuring the crop are under investigation. As a guide to agricultural policy, this information should prove of value.

Fruit other than Pineapples.

It is estimated that there are approximately 17,000 acres of fruit other than pineapples under cultivation in Johore, of which approximately 8,000 acres are under bananas and 9,000 acres under other kinds.

The past and present work of the Department of Agriculture on fruits is recounted, and the importance of organising the marketing of fruit in Johore is stressed.

Coffee.

The area under coffee in Johore is the largest of any administrative unit in the Peninsula. Coffee is a crop which responds to cultivation and treatment; it is liable to certain diseases, and there are a considerable number of varieties with different yielding properties, different resistance to disease, different size of bean and different flavour.

Experiments on cultivation, disease, and preparation of coffee are in progress at Serdang, but it is desirable that this work should be supplemented by investigations in Johore where soil and climate factors are different from those at Serdang.

Other Minor Crops.

These include a number of products such as tobacco, patchouli and other essential oil bearing crops, pepper, sireh, ginger, chillies, kapok, groundnuts and vegetables.

On tobacco quite a considerable amount of work is being done by the S.S. and F.M.S. Department, but the position is complicated by fiscal questions. On the remainder, with the exception of patchouli, a certain small amount of research has been carried out and is in progress, but limitation of resources and a heavy programme of work in other directions at present limit its scope. If additional facilities for experimental work are provided in Johore, useful work thereon could no doubt be done.

Rice.

As elsewhere in Malaya, the question of rice-growing has lately been much discussed in Johore, while economic conditions have led to considerable extension of rice cultivation.

In 1930 the area under rice in Johore was 13,000 acres of which 6,210 acres were under wet padi; in 1932-33 it was 25,060 acres of which 15,800 acres were under wet padi.

The position in relation to rice-growing in Johore differs from that in most other States in that there is no history or tradition of padi planting. Consequently the backward condition of the padi industry is not surprising. In other parts of Malaya with a much longer history of development, padi-growing arose from the needs of the population to produce food.

It is admitted now that it is desirable that rice cultivation should be extended and the yields from existing areas improved. The opening up of entirely new areas should only be undertaken with circumspection, and when the assurance exists that the population required to take them up is available; in addition, adequate facilities must exist for other forms of cultivation to supplement the income of the rice grower.

It must further be realised that in Johore, the standard of rice cultivation is lower than elsewhere.

A considerable addition to the return of rice from existing areas in Johore can be made if cultivation practice can be improved. The Johore Government would be well advised to study carefully means of improving and extending cultivation in areas where it already exists, but should be chary of attempting to open up large new areas immediately.

A decision as to the fitness of land for padi cultivation demands examination of topography and soil. Certain reconnaissances have already been made and a considerable number of soil samples examined and reported on for the Johore Government by the F.M.S. and S.S. Department of Agriculture. These reconnaissances should be continued as opportunity offers and the results kept for future guidance.

In view of the importance of irrigation, the assistance of the Irrigation Department would be of value to Johore.

So far as improvements in cultivation are concerned, these include better tillage, planting, and the use of improved strains of seed, but, to be able to advise on these subjects, experiments and demonstrations are necessary.

Test plots already laid down in Johore in conjunction with native cultivators have produced negative results.

It is suggested that the best plan is for Johore to follow the F.M.S. example and to establish a small number of test stations where accurate work may be performed and which will also serve as demonstration centres.

The suitability of padi varieties to particular environments is sometimes very restricted. This suitability can only be ascertained by experiment, and to be of value experiments must be conducted on standard lines in different districts.

In relation to research on rice the Department of Agriculture, S.S. and F.M.S., carries out a large programme of work affecting practically all aspects of the rice industry. As a result, many improved high-yielding varieties of rice have been evolved, tested out, and brought into general cultivation; manurial and cultural questions have been investigated as have also many pests and diseases.

Recommendations.

Johore is equally interested in the maintenance, development and well-being of industries other than rubber if not from the point of view of actual area cultivated, at least from the need for maintaining and expanding the many other kinds of agricultural activity that exist.

As a contribution to this, the existing provision of $3,000 per annum to the Department of Agriculture, Straits Settlements and Federated Malay States, is inadequate. The obvious solution lies in making provision commensurate with the value of the services rendered, on the undertaking that if such a contribution is made, the research service will be freely available and adequate staff and facilities will be maintained to meet fully the requirements of the State.

Reviews.

Coleopterous Pests of Stored Derris in Malaya.

By N. C. E. Miller, Special Bulletin, Scientific Series No. 14, Department of Agriculture, Straits Settlements and Federated Malay States. 1934. Price 50 cents (Straits Settlements).

Derris spp. or tuba root, is an insecticide which is commanding increasing attention in many parts of the world and especially in the United Kingdom and in America. Knowledge of its toxic properties and efficiency against various classes of insects is accumulating rapidly. Malaya and the Netherlands Indies are the countries of production of this product and on this, the producer's side, considerable investigation on methods of cultivation, valuable species, and preparation for market, has been carried out. One of the most serious obstacles against the wider use of derris in the past has been to find a convenient method of packing the raw product and the protection of the derris itself from the ravages of insect pests.

It may seem somewhat paradoxical that an insecticide should itself be subject to insect attacks.

The author gives a full account of the life histories of a number of coleopterous insects usually associated with such damage to derris, which is followed by recommendations which, if adopted, should obviate damage of this nature.

D. H. G.

Annual Reports of the Department of Agriculture, Straits Settlements and Federated Malay States.

In the compass of the Annual Report of the Director of Agriculture, little more is possible than an outline of the work of the Branches of the Department. The publication of the individual reports, therefore, has been found to be of value to investigators not only in this country but elsewhere, and such publications should be found useful for reference also by many non-officials in this country. Permanent records such as this offer an opportunity for the research worker in one country to study the methods adopted elsewhere and to seek therefrom a possible application to the immediate problems with which he is confronted.

Two recent Special Bulletins Nos. 19 and 20 of the General Series, of the Department of Agriculture, Straits Settlements and Federated Malay States, record the progress of work in that Department of the research, economic, and agricultural education branches, and of the various officers of the Field Branch, during the year 1933.

D. H. G.

Departmental.

FROM THE DISTRICTS.

Compiled by the Chief Field Officer from Monthly Reports submitted by Field Officers.

The Weather.

In Kedah, the north western areas of Perak, Malacca and Singapore rainfall was above average; in other centres precipitation was below normal. Heavy rains towards the end of the month caused minor flooding in the low-lying areas along the banks of the Jelai and Lipis rivers in Pahang.

Remarks on Crops.

Rubber.—Compared with the previous month a general decline in price was reported from all centres.

Heavy rains reduced production by curtailing tapping operations. The weather was also responsible for a recrudescence of mouldy rot disease in all areas previously infectd. A satisfactory measure of voluntary control is reported, and the Department distribution of approved fungicides at low cost is meeting an increased volume of support.

The general improvement in small holding upkeep which has become apparent since the introduction of restriction has been generally maintained. Extravagant systems of excision continue to be reported from several centres.

Further improvement in small holding manufacture, as a result of instruction work carried out by the Small Holdings Advisory Service, is recorded.

Rice.—The price for padi at the Government Rice Mill, Bagan Serai, remained unchanged, but a slight decline occurred in Kedah towards the end of the month.

In Pahang South some early harvesting is in hand in the Temerloh District, while flowering has commenced in parts of the Dong, Penjom and Sega mukims, and in the coastal areas. A poor harvest is being reaped in the Batu Pahat District of Johore.

In Kedah and the large rice-producing District of Krian, planting has been completed, and where damage was sustained as a result of flooding in early September, the plants have made an excellent recovery. Water supplies are adequate and the crop presents an execellent appearance.

In other centres, with the exception of Kelantan and the southern areas of Province Wellesley, planting is completed and favourable crop progress reported.

Coconuts and Copra.—There was a slight appreciation during the month of the Penang price for f.m.s. quality copra, the range being $3.07 to $3.15 per picul.

Following the padi-planting break, small holding production in the Krian District recommenced. Some sixty-four piculs shipped to Penang from one improved kiln realised $3.10 per picul.

Keen competition among dealers in several important producing centres has resulted in a marked rise in nut prices, the highest recorded being $14 per thousand. At this price copra production is not economic.

Improved small holding kilns continue to produce good quality copra in the Muar District of Johore. Further kilns of a good type will shortly be in production on the western coast of that State.

Fruit.—In the Jelebu District of Negri Sembilan, where a considerable export of bananas is made to markets in Singapore, Malacca, Kuala Lumpur and Seremban, durians, mangosteens, rambutans, langsats and mata kuching are being harvested. A heavy crop of durians is reported from the Ulu Lipis valley of Pahang, while machang, mempelam, chiku, mangosteen, durian, pulasan and rambutan are fruiting in the Klang District of Selangor.

Pineapples.—Harvesting commenced in the Kulai and Kota Tinggi areas in Johore, but supplies were not sufficient for factory requirements; one plant only was in use and it was operating on part-time.

Fruiting commenced in many centres in Singapore, and factory prices declined in view of forthcoming supplies. The season has also opened in the Klang and Kuala Langat Districts of Selangor, the local factory taking a portion of the crop, the balance being exported to Singapore.

Tuba.—A brisk demand exists in Singapore for good quality dried root; numerous enquiries have been made for information and planting material.

Tapioca.—Interest in this crop has been maintained in Kedah where a further area of 390 acres has been planted.

Carp Rearing.

This industry is making appreciable progress among Malays in Pahang. Recently imported fry are making very satisfactory progress at Chat, and the stock at Benta have now reached an average weight of 2½ kati each. Further ponds are in the course of construction in the mukim of Semantan.

Poultry.

Outbreaks of disease, which have so far not being diagnosed, occurred at Sitiawan in Lower Perak; Cheras and Kerling in Selangor; Ketapang near Pekan, Pahang; and in the Kukub District of Johore. Roup was present on the Sungei Udang Experiment Station, Malacca. In no case was a heavy mortality experienced.

Kampong and Home Garden Competition.

Preliminary judging has commenced in Pahang, where many gardens are reported to be of a very high standard of excellence. Enthusiasm in connexion

with these competitions has not been maintained in the Klang District of Selangor where entries are twenty-seven as compared with ninety-five for last year.

Agricultural Stations.

Good progress continues to be made on all Stations. Permanent crops such as tea, coffee and fruit are becoming established, and appreciable quantities of planting material of minor crops and food stuffs have been raised to meet an increasing demand. Considerable attention has recently been given to poultry and most Stations are now supporting flocks of pure-bred birds. Native agriculturists are evincing much interest in these demonstration centres and are increasingly appreciating the services they are intended to supply.

Padi Stations and Test Plots.

With the exception of Sungei Tontong in the Dindings, planting is now complete. Flowering has commenced at Dong and Lipis Plots in Pahang, and Jelebu in Negri Sembilan. Heavy winds have caused some lodging in Plots situated in the coastal areas of Pahang.

Two early Hongkong varieties of rice proved quite unsuitable for local conditions in Kedah. They produced grass-like foliage and very small ears; they were eventually discarded and replaced by the variety Mayang Sebatil. Hongkong varieties are also in flower at Pulau Gadong Experiment Station, Malacca, but are not comparable even with the poorest local types.

At Titi Serong the crop made a good recovery from the flood damage experienced early in September. Weeding is now in hand, pest damage is negligible, and the crop presents an attractive appearance.

Heavy rains at the beginning of the month caused much damage by flooding on the newly transplanted area recently opened up for mechanical cultivation at Pulau Gadong.

Reports on conditions generally from all experimental centres are satisfactory, and prospects for at least an average harvest are good.

DEPARTMENTAL NOTES.

Rural Broadcasting

The scheme formulated by the Propaganda and Marketing Committee for the introduction of broadcasting in the Malay language to village communities is under consideration by a sub-committee appointed by that body.

With the assistance of officers of the Posts and Telegraphs Department, tests of reception have been carried out at various centres in Selangor. The results were reasonably satisfactory in most instances.

The next step is to test suitable apparatus by means of a short programme at a particular centre, the object being not only to ascertain the suitability of the receiving set, but also the number of people who can hear at one time, as well as to select announcers.

It is hoped, if this short trial is satisfactory, to introduce an experimental weekly broadcast programme of varied items over a period of two months, commencing before the end of the present year.

The Propaganda and Marketing Committee, who have this matter in hand, is composed of officers of the Co-operative, Agriculture and Veterinary Departments and of the Rubber Research Institute.

Meeting of the Agricultural Advisory Committee.

A meeting of the Agricultural Advisory Committee was held at the Department of Agriculture, Kuala Lumpur, on 18th October 1934, when the progress of the work of the Department for the past few months was reviewed and several important questions of policy discussed.

Tours of the Director of Agriculture.

The Acting Director of Agriculture and the Acting Chief Field Officer visited Sabak Bernam and the new padi area of Panchang Bedina in that sub-District on October 13th, 14th and 15th. The improved copra kiln owned and operated by a group of Malays at Sabak Bernam was inspected and matters relating to the purchase of nuts and sale of copra were discussed.

The Panchang Bedina and Haji Durani Padi Test Stations were inspected. Notes were made on the present conditions of the new padi area and on various points in connexion with future requirements.

The Acting Director of Agriculture paid a visit of inspection on October 15th to the Dong and Kuala Lipis Padi Test Station in Pahang and to the Agricultural Station, Kuala Lipis.

Visit to Labuan and Brunei.

In accordance with arrangements at present in force for the establishment of agricultural services in Labuan and Brunei, the Agricultural Field Officer, Singapore, paid a visit to these territories between 22nd September and 23rd October, 1934.

Leave.

Mr. J. Lambourne, Assistant Agriculturist, has been granted 9 month full-pay leave from 12th October 1934 to 11th July 1935 inclusive.

Mr. T. D. Marsh, Assistant Agriculturist, returned from leave on 25th October, 1934.

DISTRICT AGRICULTURAL SHOW.

Mersing (Johore) Agricultural and Industry Exhibition.

A two-day Agricultural and Industry Exhibition was held at Mersing, Johore, on 27th and 28th September 1934. In opening the Exhibition, the Dato Mentri Besar, Johore, stressed the importance of agriculture and village industries to small-holders in that part of the State.

Sections were provided for cereals, vegetables, fruits and village industries. The exhibits in the agricultural sections were not numerous, due in the case of cereals and fruits, to the unsuitability of the dates for holding the Show. The Show was originally fixed for June, but was postponed owing to unforseen circumstances.

The Department of Agriculture staged an exhibit, and in the evenings delivered lantern lectures on agricultural subjects of particular interest to the cultivators in this District.

Statistical.

MARKET PRICES.

October 1934

Rubber.—The price of rubber continued to weaken during October and, opening at 24¼ cents per lb. for spot loose in Singapore, the market closed at 21⅞ cents per lb. The average price for the month in Singapore was 22.76 cents per lb. for Smoked Sheet equal to London Standard, as compared with 25.09 in September. The average price for October in London was 6.75 pence per lb. and in New York 13.78 cents gold per lb. as compared with 7.41 pence and 15.26 cents gold respectively in September.

Weekly prices paid during October for small-holders' rubber at three centres are shewn in the following table.

Weekly Prices Paid By Local Dealers for Small-Holders' Rubber, October, 1934.

(Dollars per Picul.)

Grades.	Kuala Pilah, Negri Sembilan.				Kuala Kangsar, Perak.				Batu Pahat, Johore.			
	4	11	18	25	3	17	24	31	3	17	24	31
Smoked sheet			26.50			26.79	26.09	25.00	26.38		24.70	24.22
Unsmoked sheet	23.21	24.07	24.06	24.09	24.74	23.15	21.99	22.00		23.05	23.28	22.32
Scrap	13.68			14.00		15.00					15.53	

Transport by lorry Kuala Pilah to Seremban 15 cents per picul, to Malacca excluding duty, 25 cents per picul, by rail Seremban to Penang $1.24 per picul, Seremban to Singapore $8.00 per ton.

Transport from Batu Pahat to Singapore by lorry excluding duty, 90 cents per picul.

Transport from Kuala Kangsar to Prai by railway $6.20 per ton.

Transport from Kuala Kangsar to Singapore by railway $10.00 per ton (minimum consignment 5 tons).

At Kuala Pilah the standard deduction for moisture in unsmoked sheet is 5 per cent.

At Kuala Kangsar the standard deduction for moisture in unsmoked sheet is 10 per cent.

No purchases at Batu Pahat and Kuala Kangsar on 10th October.

Palm Oil.—The following prices for the local commodity, c.i.f. landed weight, Liverpool, are now available :

13th September, 1934	£12. 0. 0
20th „ „	12.10. 0
27th „ „	13. 0. 0
4th October, „	13. 0. 0
11th „ „	13. 0. 0
18th „ „	13. 0. 0
26th „ „	13. 0. 0

Palm Kernels were quoted on the 26th October at £6.17.6 per ton c.i.f. Continent.

Copra.—The feature of the Singapore market was the improvement in the price of the mixed quality which rose from an opening price of $2.35 per picul to $2.70, and closed at $2.60. The sun-dried grade opened at $2.95 per picul, rose to $3.20 and closed at $2.90, averaging $3.01 as compared with $2.93 in September. The average price for the mixed quality was $2.52 as against $2.28 in September.

Copra cake weakened slightly, averaging $1.65 per picul as compared with $1.77 in September.

Rice.—The average wholesale prices of rice per picul in Singapore during October were as follows :—Siam No. 2 (ordinary) $3.39, Rangoon No. 1 $3.30, Saigon No. 1 (long grain) $3.30, as compared with $3.13, $3.16 and $3.17 in August. Corresponding prices in September, 1933 were $3.53, $2.88 and $3.22 respectively.

The average retail market prices in cents per gantang of No. 2 Siam rice in September were : Singapore 26, Penang 25, Malacca 26, as compared with 23, 24 and 23 respectively in August.

The average declared trade value of imports of rice in September was $3.38 per picul as compared with $3.03 in August and $2.85 in July.

Padi.—The price paid for padi at the Government Rice Mill, Bagan Serai, continued at $1.50 per picul; a privately owned mill paid $1.40 per picul. Prices per gantang ranged from 5 to 13 cents in various parts of the country.

Tea.—Tanah Rata (Cameron Highlands) tea was quoted in London during September at 11d. per lb. and Bigia (Kedah) tea was quoted at an average of 10.75d. per lb.

Average London prices per lb. for tea consignments from other countries were as follows :—Ceylon 1s.0.32d., Java 9.44d., Indian Northern 1s.0.85d., Indian Southern 11.05d., Sumatra 9.03d. The decline in prices continued during the month until the last week when a slight improvement was evident.

Tuba Root (Derris).—Transactions in this commodity during October were on a limited scale. The Singapore average price for roots sold on rotenone content continued unchanged at $40 per picul, but the market for roots sold on a basis of ether extract weakened still further, the average price for the month being $28 per picul as compared with $30 in September.

Coffee.—Prices in Singapore of coffee weakened during October. Sourabaya coffee opened at $19 to $20 per picul falling to $18 to $19 at the close; Palembang coffee opened at $13 per picul and fell to $12, an average for the month of $12.44 as compared with $13.19 in September.

Local prices for coffee beans ranged from $14 to $32 per picul.

Arecanuts.—October average prices per picul in Singapore were as follows:—Splits $5.31 to $6.06, Sliced $10 to $12.44, Red Whole $5.69 to $6.25, Kelantan $5.69 to $5.94, the price in each range depending upon quality. No prices were quoted for Bila Whole and Sourabaya Whole.

The average prices per picul quoted by the Singapore Chamber of Commerce were:—Best $5.48, Medium $5.05, Mixed $4.70.

Gambier.—Singapore prices continued their upward trend during October and closed at $6.75 per picul for Block, and $9.50 per picul for No. 1 Cube. The respective average prices for the month were $5.81 and $8.94 as compared with $4.40 and $7.70 in September.

Pineapples.—The Singapore market remained at a standstill, prices being nominal with no contracts passing. Prices quoted per case were:—Cubes $3.05, Sliced Flat $3, Sliced Tall $3.25. The average prices for September were $3.11, $3.05 and $3.25 respectively.

In Johore, prices for fresh fruit were: No. 1 quality $2 to $2.40 per 100, No. 2 quality $1.80 to $2 per 100, No. 3 quality $1.20 to $1.60 per 100. Prices in Singapore at factories were $2.20 per 100 for large fruit and $1.60 per 100 for small fruit. Prices in Selangor ranged from 50 cents to $3 per 100 according to quality and $3 to $10 per 100 for Sarawak pines.

Tapioca.—The Singapore market remained unchanged during October with the exception of Flake Fair which weakened to $3.40 in the second half of the month.

Average prices per picul were:—Flake Fair $3.45, Seed Pearl $5.50, Pearl Medium $5.85, as compared with $3.65, $5.70 and $5.85 respectively in September.

Sago.—Singapore prices of Pearl, Small Fair, remained unchanged at $3.90 per picul throughout the month, but Flour, Sarawak Fair, improved with increased demand averaging $2.03 per picul. The September average prices were $3.94 and $1.92½ respectively.

Mace.—Although very little business was passing Singapore prices remained high and unchanged throughout the month owing to stocks being light. Prices were: Siouw $90, Amboina $60 per picul as compared with average prices of $90 and $57 respectively in September.

Nutmegs.—There was good enquiry for nutmegs during October and prices improved accordingly. Average prices were $25 per picul for 110's and $26 per picul for 80's an increase of $1 per picul in each case as compared with September.

Pepper.—The market was again considerably affected by speculative buying in London which forced up prices, Singapore White closing at $61 per picul and Muntok White $63 per picul. Average prices per picul in Singapore for the month were :—Singapore Black $18.88, Singapore White $55.50, Muntok White $57.38, as compared with $15.50, $40.30 and $41.70 respectively.

Cloves.—Singapore prices continued nominal at Zanzibar $35 and Amboina $45 per picul.

Tobacco.—Prices of sun-dried leaves ranged from $6 to 48 per picul according to quality. Java tobacco was quoted in Perak at $60 to $70 per picul and in Johore at $40 to 80 per picul.

The above prices are based on London and Singapore daily quotations for rubber; on the Singapore Chamber of Commerce Weekly Reports for the month and on other local sources of information. Palm oil reports are kindly supplied by Messrs. Guthrie & Co. Ltd., Kuala Lumpur; the Singapore prices for coffee and arecanuts by the Lianqui Trading Company of Singapore, and tuba prices by Messrs. Mackay & Co., Singapore.

1 picul = 133⅓ lbs. The Dollar is fixed at two shillings and four pence.

Note.—The Department of Agriculture will be pleased to assist planters in finding a market for agricultural produce. Similar assistance is also offered by the Malayan Information Agency, 57, Charing Cross, London, S.W.1.

GENERAL RICE SUMMARY.*

September 1934.

Malaya.—Imports of foreign rice into Malaya during September were 67,441 tons and exports 17,096 tons, net imports accordingly being 50,345 tons. For the period January to September, 1934, net imports were 352,586 tons, an increase of 11.6 per cent.†

Of the imports during September, 50 per cent. were consigned to Singapore, 15 per cent. to Penang, 6 per cent. to Malacca, 20 per cent. to the Federated Malay States and 9 per cent. to the Unfederated Malay States. Of the total, 69 per cent. came from Siam, 28 per cent. from Burma, 2 per cent. from French Indo-China and 1 per cent. from other countries.

Of the exports during the month under review, 67 per cent. were shipped to the Netherland Indies and 33 per cent. to other countries. The various kinds of rice exported were: Siam 11,081 tons (64.8 per cent.), Burma 3,760 tons (22 per cent.), French Indo-China 354 tons (2 per cent.), India 1,789 tons (10.5 per cent.), local production 112 tons (0.7 per cent.).

India and Burma.—Foreign exports for the period January to August, 1934, totalled 1,121,000 tons, as compared with 1,465,000 tons in 1933, a decrease of 23.5 per cent.

Total exports of rice and bran from Burma for the period 1st January to 1st September, 1934, amounted to 3,085,275 metric tons as compared with 2,591,490 metric tons in 1933, an increase of 19 per cent.

According to the *Indian Trade Journal,* 4th October, 1934, the exportable surplus from Burma from the new crop was estimated at 3,200,000 tons (all kinds of rice and rice products), a decrease of 250,000 tons or 7.2 per cent. as compared with the forecast of the previous year.

The first forecast of the crop in Burma for the season 1934-35, states that the area likely to mature is estimated at 12,496,700 acres, a decrease of 78,600 acres or 0.6 per cent. as compared with the corresponding estimate for the season 1933-34, and an increase of 32,400 acres or 0.3 per cent. as compared with the final figures for that season. A good harvest is indicated for the Province as a whole if the October rains prove favourable.

Siam.—August exports of rice from Bangkok were 191,246 tons, giving a total of 1,198,810 tons for the period January to August as compared with 1,104,135 tons in 1933.

Japan.—The 1934 rice crop of Japan Proper has been estimated at 7,998,146 tons, which is 19.5 per cent. less than the actual crop of 1933 and 8.9 per cent. less than the average of the previous five years.

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* Abridged from the Rice Summary for September, 1934, compiled by the Department of Statistics, Straits Settlements and Federated Malay States.

† It is to be understood throughout the summary that all comparisons and percentage increases or decreases are in relation to the corresponding period of 1933.

The area under rice in Formosa for the first crop of 1934 was 712,605 acres, an increase of 5,034 acres or 0.7 per cent. as compared with the corresponding crop of 1933. Production amounted to 632,658 tons, which is 80,265 tons or 14.5 per cent. more than was harvested during the same season in 1933.

French Indo-China.—Entries of padi into Cholon, 1st January to 30th September, 1934, totalled 1,246,700 metric tons, an increase of 37 per cent. as compared with 910,007 metric tons in 1933.

Exports of rice for the same period this year were 1,141,821 metric tons, an increase of 10.3 per cent. as compared with 1,035,464 metric tons in 1933.

The report on the Saigon Rice Market for September 1934 indicates that there was an almost entire lack of enquires from abroad and prices accordingly weakened, the market closing on a falling tendency.

Netherlands Indies.—Imports of rice for the period January to July, 1934, (*Economic Bulletin* 1st October, 1934) totalled 107,404 metric tons, a decrease of 57.9 per cent. as compared with imports of 255,734 metric tons in 1933.

The area under rice in Java and Madura harvested during this period was 7,595,250 acres, as compared with 7,713,810 acres in 1933, a decrease of 1.5 per cent.

Ceylon.—For the period January to September, 1934, imports totalled 359,577 tons, an increase of 10.9 per cent. as compared with 324,331 tons in 1933. Of the 1934 imports 14.5 per cent. were from British India, 62.9 per cent. from Burma and 22.6 per cent. from other countries.

Europe and America.—Shipments to Europe from the East were 950,032 tons for the period 1st January to 20th September 1934, as compared with 1,028,482 tons in 1933, a decrease of 7.6 per cent.

Of the 1934 shipments, 39 per cent. were from Burma, 5 per cent. from Japan, 45 per cent. from Saigon, 9 per cent. from Siam and 2 per cent. from Bengal. The corresponding percentages for 1933 were 51, 2, 39, 7 and 1 respectively.

Shipments to the Levant from the East for the period 1st January to 11th August, 1934, were 22,899 tons, an increase of 8.6 per cent. as compared with 21,087 tons in 1933.

Shipments to the West Indies and America for the period 1st January to 22nd August, 1934, were 138,626 tons, an increase of 15.8 per cent. as compared with 119,703 tons in 1933.

MALAYAN AGRICULTURAL EXPORTS, SEPTEMBER, 1934.

PRODUCT.	Net Export in Tons.				
	Year 1933.	Jan.-Sept. 1933.	Jan.-Sept. 1934.	September 1933.	September 1934.
Arecanuts ...	20,756	14,930	14,569	1,417	1,056
Coconuts, fresh ...	100,609†	78,454	72.366	10,388	7,270
Coconut oil ...	17,568	13,048	18,348	1,289	2,081
Copra ...	110,543	73,037	66,676	12,492	6,151
Gambier, all kinds ...	2,560	1,802	1,598	165	151
Oil cakes ...	9,992	7,616	8,255	778	945
Palm kernels ...	1,983	1,433	2,077	285	191
Palm oil ...	12,101	7,118	10,239	988	1,515
Pineapples canned ...	59,582	49,718	56,837	2,873	2,973
Rubber ...	459,836¶	331,796¶	351,881¶	39,897¶	42,097¶
Sago,—flour ...	7,648	2,605	5,560	245*	814
„ —pearl ...	2,646	1,644	3,551	214	436
„ —raw ...	4,420*	3,070*	4,736*	421*	615*
Tapioca,—flake ...	9,881	7,950	4,939	711	323
„ —flour ...	702*	195*	1,476*	69*	160*
„ —pearl ...	17,297	12,932	12,077	1,324	1,349
Tuba root ...	569½	343½	422	30	40½

† hundreds in number. * net imports. ¶ production.

MALAYAN PRODUCTION IN TONS OF PALM OIL AND KERNELS 3rd QUARTER, 1934.

(As declared by Estates)

	Palm Oil		Palm Kernels	
	F. M. S.	Johore	F. M. S.	Johore
July	1,111.4	586	162.1	118.0
August	1,486.7	479	211.1	75.5
September	1,467.6	411	206.2	61.3
Total	4,065.7	1,476	579.4	258.4

MALAYA RUBBER STATISTICS

ACREAGES OF TAPPABLE RUBBER NOT TAPPED ON ESTATES OF 100 ACRES AND OVER, FOR THE MONTH ENDING 30TH SEPTEMBER, 1934.

STATE OR TERRITORY	Acreage of Tappable Rubber end 1933 (*d*)	ESTATES WHICH HAVE ENTIRELY CEASED TAPPING		ESTATES WHICH HAVE PARTLY CEASED TAPPING (*a*)		AREA OF TAPPABLE RUBBER NEVER BEEN TAPPED		Total (3) + (5)	Percentage of (9) to (2)
		Acreage	Percentage of (3) to (2)	Acreage	Percentage of (5) to (2)	Acreage	Percentage of (7) to (2)		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
STRAITS SETTLEMENTS :—									
Province Wellesley	44,285	1,129	2.5	8,576	19.4	570	1.3	9,705	21.9
Dindings	7,368	112	1.5	844	11.5	195	2.6	956	13.0
Malacca	121,152	584	0.5	16,785	13.8	3,123	2.6	17,369	14.3
Penang Island	1,366	185	13.5	424	31.0	201	14.7	609	44.5
Singapore Island	28,842	3,910	13.5	4,319	15.0	523	1.8	8,229	28.5
Total S.S. ...	203,013	5,920	2.9	30,948	15.2	4,612	2.3	36,868	18.1
FEDERATED MALAY STATES :—									
Perak	253,227	3,667	1.4	37,101	14.7	13,989	5.5	40,768	16.1
Selangor	310,003	4,291	1.4	43,342	14.0	12,369	4.0	47,633	15.4
Negri Sembilan	233,592	4,979	2.1	34,466	14.8	18,468	7.9	39,445	16.9
Pahang	46,712	4,449	9.5	13,966	29.9	9,400	20.1	18,415	39.4
Total F.M.S. ...	843,534	17,386	2.0	128,875	15.3	54,226	6.4	146,261	17.3
UNFEDERATED MALAY STATES :—									
Johore	365,400	10,324	2.8	25,743	7.1	22,179	6.1	39,067	9.9
Kedah (*b*)	126,588	1,632	1.3	28,816	22.8	19,550	15.4	30,448	24.1
Kelantan	25,793	8,471	32.8	129	0.5	5,418	21.0	8,600	33.3
Trengganu (*b*)	4,543	Nil	Nil	98	2.2	98	2.2	98	2.2
Perlis (*c*)	1,181	Nil	Nil	266	22.5	266	22.5	266	22.5
Total U.M.S. ...	523,505	20,427	3.9	55,052	10.5	47,511	9.1	75,479	14.4
TOTAL MALAYA ...	1,570,052	43,733	2.8	214,875	13.7	106,349	6.8	258,608	16.5

Notes :—(*a*) Area out of tapping on Estates which have partly ceased tapping refers to areas definitely being rested and excludes areas on any tapping round.
(*b*) Registered Companies only.
(*c*) Rendered quarterly.
(*d*) Figures are as reported by estate managers.

Stocks, Production, Imports and Exports of Rubber, including Latex, Concentrated Latex and Revertex, for the Month of September, 1934, in Dry Tons.

State or Territory	Stocks at beginning of month 1			Production by Estates of 100 acres and over		Production by Estates of less than 100 acres estimated 2		Imports				Exports including re-exports				Stocks at end of month		
								during the month		January to Sept. inclusive 1934		during the month		January to Sept. inclusive 1934				
	Ports	Dealer	Estates of 100 acres and over	during the month	January to Sept. inclusive 1934	during the month	January to Sept. inclusive 1934	Foreign	From Malay States & Labuan	Foreign	From Malay States & Labuan	Foreign	Local	Foreign	Local	Ports	Dealers	Estates of 100 acres and over
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
MALAY STATES :—																		
Federated Malay States ...	...	11,576	9,137	12,530	106,054	9,343	79,861	Nil	Nil	Nil	Nil	16,540	3,299	134,951	61,781	...	13,189	9,546
Johore ...	...	2,518	2,509	3,977	33,530	5,435	40,633	Nil	2	Nil	272	1,744	6,820	14,742	60,303	...	3,081	2,796
Kedah ...	...	393	1,927	2,495	24,365	1,762	13,720	Nil	Nil	Nil	Nil	1,522	2,370	13,290	24,942	...	684	2,001
Perlis ...	...	32	12	8	119	8	277	Nil	Nil	Nil	Nil	Nil	19	Nil	398	...	23	18
Kelantan ...	...	231	246	379	2,257	625	6,141	Nil	Nil	319	Nil	71	918	803	7,840	...	211	281
Trengganu ...	...	55	50	291	2,064	145	1,029	Nil	Nil	Nil	Nil	Nil	436	Nil	3,093		55	50
Total Malay States	...	14,805	13,881	19,680	168,389	17,318	141,661	Nil	2	319	272	19,877	13,862	163,786	158,317	...	17,243	14,692
STRAITS SETTLEMENTS :-																		
Malacca ...	...	2,905	921	1,574	12,440	1,903		Nil		4		2,718		29,114		...	3,162	976
Province Wellesley	...	1,849	491	526	5,131	291		Nil		Nil						...	1,504	443
Dindings ...	...	40	139	107	974	120		Nil	14,557	Nil	147,767	9,578	Nil	74,507	Nil	...	82	144
Penang ...	3,394	14,412	12	9	109	120	21,525	2,192		21,817						2,695	12,735	9
Singapore ...	9,640	44,815	258	209	1,652	240		15,866		155,303		28,878		252,19		7,431	42,170	174
Total Straits Settlements	13,034	64,021	1,821	2,425	20,306	2,674	21,525	18,058	14,557	177,124	147,767	41,174	Nil	355,815	Nil	10,126	59,653	1,746
TOTAL MALAYA	13,034	78,826	15,702	22,105	188,695	19,992	163,186	18,058	14,559	177,443	148,039	61,051	13,862	519,601	158,357	10,126	76,896	16,438

TABLE II
DEALERS' STOCKS, IN DRY TONS 3

Class of Rubber	Federated Malay States	S'pore	Penang	Province We'sly D'dings M'cca.	Johore	Kedah
20	21	22	23	24	25	26
DRY RUBBER	11,569	35,804	9,729	4,335	1,918	338
WET RUBBER	1,620	6,366	3,006	413	1,163	346
TOTAL ...	13,189	42,170	12,735	4,748	3,081	684

TABLE III
FOREIGN EXPORTS

PORTS	For month	January to Sept. 1934
Singapore ...	39,029	348,147
Penang ...	14,564	114,623
Port Swettenham.	6,895	51,484
Malacca ...	563	5,347
MALAYA ...	61,051	519,601

TABLE IV
DOMESTIC EXPORTS 4

AREA	For month	January to Sept. 1934
Malay States ...	33,737	311,268
Straits Settlements	4,105	4,105
MALAYA ...	37,842	315,373

Notes:—

1. Stocks on estates of less than 100 acres and stocks in transit on rail, road or local steamer are not ascertained.
2. The production of estates of less than 100 acres is estimated from the formula: Production + Imports + Stocks at beginning of month = Exports + Stocks at end of month, + Consumption, *i.e.*, Column [9] = Columns [15] + [16] + [19] + [20] + [21] + [22] − [4] − [5] − [6] − [7] − [11] − [12]. For the Straits Settlements, Column [9]: figures for Singapore and Penang Islands represent sales or exports as shown by cess paid and for the mainland represent as previously purchases by dealers from local estates of less than 100 acres, reduced by 15 % to terms of dry rubber.
3. Dealers' stocks in the Federated Malay States are reduced to dry weights by the following fixed ratios: unsmoked sheet, 15% wet sheet, 25% scrap, lump, etc., 40%; stocks elsewhere are in dry weights as reported by the dealers themselves.
4. Domestic exports are reported by the Customs Authorities for the Malay States and by the Registrars of Imports and Exports for Province Wellesley, Malacca, Dindings Labuan and Brunei. For Singapore and Penang Island domestic exports are represented by sales or exports of rubber as shown by cess paid.
5. The above, with certain omissions, is the Report published by the Registrar-General of Statistics, S.S. and F.M.S., at Singapore on 23 October, 1934.

METEOROLOGICAL SUMMARY, MALAYA, SEPTEMBER, 1934.

Locality.	Air Temperature in degrees Fahrenheit							Earth Temperature		Rainfall								Bright Sunshine.		
	Means of			Absolute Extremes						Total.		Most in a day.	Number of days.					Total.	Daily Mean.	Per cent.
	A. Max.	B. Min.	Mean of A and B.	Highest Max.	Lowest Min.	Lowest Max.	Highest Min.	At 1 foot	At 4 feet			Amt.	Precipitation .01 in or more	Precipitation .04 in or more	Thunder-storm	Fog morning obs.	Gale force 8 or more			
	°F	°F	°F	°F	°F	°F	°F	°F	°F	in.	mm.	in.								
Railway Hill, Kuala Lumpur, Selangor ...	90.0	71.4	80.7	94	69	83	74	83.7	84.4	7.12	180.9	3.22	18	12	3	1	1	144.75	4.83	40
Bukit Jeram, Selangor ...	87.7	72.2	79.9	91	69	83	75	82.7	84.4	5.47	138.9	2.10	15	10	3	1	2	154.35	5.15	43
Sitiawan, Perak ...	88.3	72.1	80.2	92	71	79	74	83.0	84.7	7.91	200.9	2.93	14	12	1			135.15	4.57	37
Temerloh, Pahang ...	89.7	72.4	81.1	92	70	84	74	84.7	85.9	6.21	157.7	2.56	15	13	1	12		166.45	5.55	46
Kuala Lipis, Pahang ...	88.0	71.2	79.6	90	69	83	74	83.4	84.4	4.54	115.3	1.03	14	11	1	25		144.10	4.80	40
Kuala Pahang, Pahang ...	87.1	73.5	80.3	90	72	84	76	85.1	86.2	7.87	199.9	1.50	21	19	5		2	217.45	7.25	60
Kallang Aerodrome, S'pore ...	86.6	76.3	81.5	90	72	82	79	81.9	82.9	4.57	116.1	1.39	9	7	2	3		177.05	5.90	49
Butterworth, Province Wellesley ...	85.9	73.9	79.9	89	71	76	76	82.1	84.1	21.73	551.9	6.77	18	14	2		1	136.80	4.56	38
Bukit China, Malacca ...	84.7	73.6	79.1	87	71	82	76	83.1	83.7	6.67	169.4	1.47	18	15				157.85	5.26	43
Kluang, Johore ...	88.1	70.8	79.5	91	67	82	73	81.5	81.9	2.07	52.6	0.61	11	9		8		150.95	5.03	42
Bukit Lalang, Mersing, Johore	87.3	71.7	79.5	90	68	81	75	80.8	81.3	6.92	175.8	1.06	22	19	3	4		177.35	5.91	49
Alor Star, Kedah ...	86.4	74.1	80.3	89	71	77	76	85.2	85.3	12.20	309.9	1.60	17	17	3		1	163.35	5.45	45
Kota Bahru, Kelantan ...	88.9	73.4	81.1	92	71	85	76	84.7	85.0	8.12	206.3	2.49	17	14	7			171.40	5.71	46
Kuala Trengganu, Trengganu	88.5	72.7	80.6	91	71	86	75	83.2	84.6	8.24	209.3	1.46	19	17	6			185.40	6.18	51
HILL STATIONS.																				
Fraser's Hill, Pahang 4268 ft. Pahang ...	74.4	62.5	68.5	78	60	67	64	70.8	71.8	5.03	127.8	1.21	16	13		1	2	142.25	4.74	39
Cameron Highlands, Tanah Rata, Pahang 4750 ft. ...	71.6	56.5	64.1	75	51	67	62	70.2	69.9	10.03	254.8	1.68	23	20	1		1	122.50	4.08	34
Cameron Highlands, Rhododendron Hill, Pahang 5120 ft. ...	70.7	58.7	64.7	74	56	65	60			10.37	263.4	1.71	21	19			1	132.40	4.41	36